All of this is not in bound volume

TWENTY-EIGHTH ANNUAL REPORT

OF THE

New York State Museum of Natural History,

BY

THE REGENTS OF THE UNIVERSITY

OF THE

STATE OF NEW YORK.

[EX-OFFICIO TRUSTEES OF THE MUSEUM.]

STATE MUSEUM EDITION.

TRANSMITTED TO THE LEGISLATURE MARCH 30, 1875.

ALBANY:
WEED, PARSONS AND COMPANY, PRINTERS
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No. 71.

IN SENATE,

March 30, 1875.

TWENTY-EIGHTH ANNUAL REPORT

ON THE STATE MUSEUM OF NATURAL HISTORY, BY THE REGENTS OF THE UNIVERSITY OF THE STATE OF NEW YORK.

UNIVERSITY OF THE STATE OF NEW YORK:
OFFICE OF THE REGENTS,
ALBANY, *March* 30, 1875.

To the Hon. WILLIAM DORSHEIMER,

President of the Senate.

SIR — I have the honor to transmit the Twenty-eighth Annual Report on the State Museum of Natural History, by the Regents of the University.

I remain, very respectfully,

Your obedient servant,

JOHN V. L. PRUYN,
Chancellor of the University

REGENTS OF THE UNIVERSITY.

(Ex officio Trustees of the State Museum of Natural History.)

STANDING COMMITTEE OF THE REGENTS,

SPECIALLY CHARGED WITH THE CARE OF THE STATE MUSEUM

1875.

REPORT.

To the Honorable the Legislature of the State of New York:

The Regents of the University, as trustees of the State Museum of Natural History, respectfully submit this their Twenty-eighth Annual Report:

The report of the Director of the Museum herewith communicated, shows the work of the last year and the present condition of the Museum. From this it will appear that valuable additions have been made, and that the plan of arrangement has been very decidedly advanced.

The Museum has increased beyond the capacity of the building. Many parts are greatly crowded and it is difficult properly to exhibit some of the most valuable collections. This embarrassment will continue and increase until more ample room is provided, for a museum of natural history, in the nature of things, can never be stationary. New objects of interest will be discovered, and these must be preserved and exhibited.

The report of the Botanist shows that he has prosecuted his work with the zeal of a true naturalist, and that he has been rewarded by the discovery of many species hitherto undescribed. He has literally added to the stores of botanical knowledge.

The object of the museum is to gather and exhibit objects which illustrate the natural history of the state, and to publish the results of investigations made in the different departments of science indicated by its designation, and is worthy of liberal provision by a great State. It is commended to the continued confidence of the legislature.

Respectfully submitted in behalf of the Regents.

JOHN V. L. PRUYN,
Chancellor.

S. B. WOOLWORTH,
Secretary.

REPORT ON THE STATE MUSEUM.

CONTENTS.

PREFATORY NOTE

TO THE

STATE MUSEUM EDITION OF THE 28TH REPORT.

[This report was originally communicated to the Legislature in 1875, and printed as a Legislative Document in 1876.]

The reports of the State Museum of Natural History, with the accompanying scientific papers, are communicated to the board of Regents of the University in the month of January of each year, and by the Chancellor of the board are transmitted to the Legislature of that year. All the reports thus transmitted are printed to the number of 800 copies, as State documents; any greater number are printed only on special order or resolution of the Legislature, and it had so happened that no such order was given regarding the 27th, 28th, 29th and 30th reports, which were printed only as documents in the regular course of State printing.

In 1878, a special appropriation was made (chapter 252 of Laws of 1878,) for printing the usual Museum edition of the reports above-named, together with additional matter to be included in the 28th and 30th reports.

The present report, in addition to the matter contained in the Documentary edition, includes descriptions of all the species of fossils illustrated on plates 3-34 inclusive, with some revision of the nomenclature of the species: also, pages 205–210, with plates 35–37 in illustration. The 30th report contains additional matter from page 117 to page 256 inclusive.

ALBANY, *December*, 1879.

REPORT OF THE DIRECTOR.

ALBANY, *January* 9, 1875.

To the Honorable the Board of Regents of the University of the State of New York:

GENTLEMEN:

I have the honor to present herewith the Annual Report upon the condition of the collections in the State Museum of Natural History; the additions thereto by collection through its officers; by purchase and donation; and a statement of the work done in the Museum.

The collections in the several departments are all in good order, and the re-arrangement of some portions, referred to in my Report of last year, is now going on, and we hope within a few months to have all the material in such order that new catalogues of the Museum Collections may be commenced.

I must again call your attention to the want of space for the proper arrangement of the New York Palæozoic fossils; and likewise to the necessity of immediate provision of more room for the arrangement of the Zoölogical collections. We are at the present time entirely unable to find place in the cases for the recent additions; and place for other specimens will soon be required.

In regard to the need of more accommodation in the different departments, and the want of working rooms, I might repeat essentially what I stated in my Report of last year,—though in one or two points there is an improvement, as will appear further on.

The present condition of the Museum, with its constantly accumulating collections, and the want of space in nearly every direction, demands from the Trustees their especial attention. While we desire to perform our duty both to the scientific world and to the general public, we cannot satisfy the demands of the latter without provision for the exhibition of material which is constantly increasing on our hands, and which ought to be placed on exhibition in proper cases.

By the authorization of the Commissioners of the Land Office — the custodians of the building — some changes have been made in the interior arrangement of the Director's Room, which were really indispensable for the preservation of the valuable Botanical collection. The new cases for this collection, constructed two years ago, were then located in what appeared as the only available space: but it was found to be too near the heated wall and the register of the furnace; and these, with two other cases formerly containing the entire Herbarium, have been removed to the west side of the room, and a small addition made to fill the space. The cases of the Herbarium now occupy the entire west side of the room; and besides presenting a far better appearance, afford greater facilities for the arrangement and examination of the collections.

The Library cases now occupy the south side of the room; and a case used for the reception of miscellaneous objects of natural history has replaced the botanical cases in the north-east corner of the apartment. I believe that the present arrangement will commend itself to the Trustees as in every way the most appropriate which, under the circumstances, can be devised.

The Economic Collection — building-stones and marbles — remains essentially as previously reported, with few additions during the past year, and scarcely any room for the display of further contributions.

On the First Foor, additional representation of the fauna of the Potsdam Sandstone period has been made, in some large slabs containing *Lingulepis pinnaformis* (Owen), etc., from collections by the Director at the Falls of St. Croix, Minn., in 1850 and in 1865.

Some other additions have been made to the Palæontological series, mainly from the materials of the Gebhard collection, which have passed under review, either in the preparation of the Palæontology of N. Y., or in the distribution of duplicate specimens to the Institutions of the State, as provided by law.

In the table-cases devoted to the Lithological series, fifty-one species of fossils of the lower carboniferous limestone from Missouri, Indiana and Illinois have been arranged, and thirty species of fossils of the coal measures, mainly from Illinois and Kentucky. These are temporarily placed here, until a more suitable place may be provided.

The relabeling of the Lithological series, with the identification and designation of the specimens collected during the early geological survey of the state, has been continued and extended over the new red sandstones, drift specimens, sands, clays, marls, peat and tufas. There now remain of these rocks, to be relabeled only the specimens belonging to the Trenton group. The labeling of the Laurentian group is not perfectly satisfactory and will need to be revised.

The material of the quaternary period, contained in the wall-cases, has been re-arranged in proper grouping and order of succession.

In the wall-cases of the Helderberg group, have been added among a number of others the following: an unusually large specimen of *Favosites conica* Hall, and several large fossiliferous slabs from the Gebhard collection, viz., three of the Upper Pentamerus Limestone, five of Oriskany Sandstone, and three of the Hamilton group.

On the second floor the re-arranging and relabeling of the Eocene fossils from the Paris basin, and of the American Eocene and Cretaceous fossils, which was in progress at the date of the last report, has been completed during the past year. In one of the cases containing these, a small collection of Post Pleiocene fossils from the Champlain Valley, has been arranged and labeled.

Several large and very fine blocks of Calcite from the Gebhard collection, satin-spar and other cave-forms have been placed in the mineralogical collection.

The collection of New York Minerals located on this floor, has long been in a condition discreditable to the Museum. While other departments have presented a steady if not rapid progress, this has been allowed to remain very nearly in the condition in which it was left more than twenty-five years ago. A few valuable additions had been made to it from purchased collections, and specimens donated by friends of the Museum had been incorporated with it, without always adding to its value. In the report of the Director given last year, some improvements in the arrangement of this collection were noted. Provision has now been made for the entire revision and relabeling of the collection. The services of Prof. Chester, of Hamilton college, have been secured for the work, and considerable progress has already been made.

As the more economical method the minerals are taken from the shelves, packed and forwarded to Prof. Chester, at Clinton. Nine boxes containing about eight hundred specimens, have been sent to him, which are already labeled, arranged and returned to the Museum.

From the want of time consequent on the necessity of preparing the Duplicate collections for distribution, in compliance with the repeated calls from various quarters for these collections, the returned Minerals have not yet been placed on the shelves.

So numerous are the demands continually made upon all connected with the Museum, both for legitimate Museum duties, and to meet the various requirements made by individuals, by the educational Institutions of the State, and by scientists throughout the United States, that it often becomes a perplexing task for the Director to determine to which apparently imperative duty claiming immediate attention, shall be given precedence. Under this condition of things — with means wholly inadequate to the requirements — much important work must be left, at least for the time, undone.

In one of the temporary Table-cases of the second floor, a collection of over four hundred clay-stones from the Gebhard collection, has been arranged. These, with several hundred more, were collected, during a period of many years, from a single locality on Foxes creek, at Schoharie, N. Y. They are

interesting for study, displaying lines of stratification and other features, by the aid of which large series of them can be definitely grouped and referred to the corresponding strata in the clay beds, where their strange and often beautiful forms were developed.

Through the expenditure authorized by the Commissioners of the Land Office, a greatly needed requirement of the Museum, viz., a working-room on each floor, has been in part supplied. Hitherto whenever extensive examination, comparison or relabeling of any of the material of the collections were required, it was necessary to carry it down one, two, three or four stair ways to the director's room or to the hall below, incurring, in transit, in addition to the labor involved, the risk of displacement of labels, and by a single misstep, an irreparable injury to the more fragile zoölogical specimens.

With some iron-railing, which had formerly been in use in the Museum, an inclosure of nine feet by twenty-three has been constructed on the central portion of this floor. Upon the rails, a wire netting is carried up to a sufficient height to give protection to whatever material may be under examination or preparation on the tables within. Three sides of the inclosure are occupied with the tables, giving seventy-eight square feet of area, and beneath one of them sixty drawers are arranged, having an area of one hundred and sixty-five square feet.

Until this room was provided, it was impracticable to undertake the long contemplated revision of the North American land and fresh-water shells, which will now be proceeded with as soon as the services of Dr. Lewis can be obtained.

On the Third Floor, valuable additions have been made to the alcoholic collection of Echino dermata, Mollusca, Crustacea and Pisces, through collections made at Cape Cod Bay and Penikese Island, by the Director and Mr. C. E. Hall, which will be found recorded in their proper place. Several of the species were obtained in sufficient quantity to afford numerous duplicate specimens for exchanges.

Several dissections of *Lepas fascicularis*, exhibiting both the outer and inner surfaces of the carina, the terga, and the scuta, have been arranged among the New York Crus-

taceans in the case of Invertebrata; also groups of individuals attached to sea-weeds, with their filamentary appendages finely shown.

The annual appropriation for the special increase of the Zoölogical collection, which we received for several years, having been withheld the past year, I am unable to report any extensive additions to the skeletons of the New York Vertebrata. Some preparations of the foot-bones of Mammals and Birds have been made and mounted by Dr. J. W. Hall, Assistant in the Museum, and placed in the collection; and the series of skulls has been re-labeled.

An addition, of some interest, to the stuffed skins of the New York Mammalia, is that of an Albino Mink, which was killed in a barn near Greenbush, N. Y.

A very interesting addition to the collections of this floor is a specimen of the Horse-Mackerel, American Tunny (*Orcynus secundi-dorsalis* Storer), of which I was so fortunate, during a short sojourn on the sea-coast last summer, as to procure three specimens which had become stranded in a fish-wier in Cape Cod Bay. The largest of these, an unusually large individual, measuring nine feet and four inches in length, has been stuffed and mounted by Prof. Ward of Rochester, and is now in position over the case containing the alcoholic collection of New York fishes.* The skeleton of another is in course of preparation, and will soon be received at the Museum, while the skin of the third specimen is in preparation by Mr. J. Wallace, of New York.

These specimens are a valuable acquisition to the collections. The estimated weight of the Museum specimen was eight hundred pounds. This fish is known on the American coast from Newfoundland to Florida. In Massachusetts Bay it is called Horse-Mackerel, and in Rhode Island and elsewhere it is known as Albicore or Albricore. It was for a long time supposed to be identical with the Tunny of Europe (*Thynnus vulgaris*), which occurs often in immense numbers

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* It has since been removed to the large wall-case containing the skeletons of Mammalia and the larger stuffed Fishes.

in the Mediterranean sea. It was referred to this species by De Kay, but has since been found to be distinct.

A list in detail of the additions and their source, in each one of the Departments of the Museum, will be found appended to this Report.

ADDITIONS TO THE MUSEUM BY DONATION.

To the Zoölogical department, donations are recorded from twenty-six individuals and Institutions of about one hundred and ten distinct lots of specimens.

To the Botanical department, donations have been received from twenty-six sources.

To the Geological, Mineralogical, and Palæontological departments, seventeen donors.

To the Archæological and Ethnological department, six donors.

To the Library fifteen individuals and societies have made donations (to some of these Museum Reports had been sent and contributions were received in return), adding to the Library twenty-one pamphlets and three bound volumes.

The whole number of contributors to the several departments during the year is ninety.

GENERAL WORK OF THE MUSEUM.

During the past year, the Assistants in the Museum have been faithfully engaged in the work allotted to them.

Mr. Callaway, who had been specially employed in the work of selecting and labeling the duplicate fossils for distribution, left the Museum on the first of June on account of the failure of the appropriation to continue his salary beyond that time.

The regular work of distribution of duplicate specimens was continued till May, when the large room in the Agricultural department, which we had been permitted to use, was required for other purposes. The distribution has since been carried on at intervals and so far as facilities permitted.

The collections ordered, by the several laws of the State, for distribution to Institutions of learning, have been, so far as finished, packed in boxes, and are ready to be sent to their destination. Those for the Syracuse University have already been sent forward, in accordance with an expressed wish of the Chancellor of that Institution.

In making the distribution into the series required, there were certain species of fossils and minerals in greater number than needed for the authorized sets. These have been distributed in series; some of them running to twenty sets; so that we have a number of smaller sets of specimens, which would be of great use for instruction in the Normal Schools of the State. One of these collections has already been sent to the Oswego Normal and Training School, and has proved very acceptable to the Principal and the Professor of Natural Sciences of that Institution.

I would recommend that the Board of Regents take some action regarding this matter, and if necessary secure authority for the distribution of these collections to proper Institutions. I venture to make this suggestion in view of the frequent applications from persons to have collections of fossils and minerals sent by the Museum to schools and scientific societies.

The Economic collection of Iron ores on the first floor has been re-arranged and relabeled.

Some additions have been made by Mr. Lintner to the Invertebrate collection, illustrating the different stages of insect life and architecture; a list of which will be found among the additions to the collections.

The alcoholic collection has been much improved in condition and appearance by the substitution of new glass jars which have been specially made of a size and form adapted to the wants of the collection.

A list of fossils described in the Annual Reports of the State Museum, up to the twenty-sixth report, comprising over 1,200 species, has been prepared for publication, and will appear as soon as a general and synonymic revision can be given to the work.

Mr. Andrew Sherwood, with the assistance of his brother Mr. Clark Sherwood, has continued the investigations in the Chemung group and Catskill mountain formation. At the same time, they have made extensive collections of the rocks and fossils, which have been received at the Museum.

The field-work has been essentially completed, and Mr. Sherwood has been for some time engaged in the preparation of the map and sections. This work was originally undertaken with a view of tracing more accurately the limits of the several formations in the southern counties of the State, a work which could not be satisfactorily accomplished during the original geological survey. On several occasions questions had arisen regarding the existence of certain formations within the limits of the State; and in the report on the State Cabinet of 1862, the curator (E. Jewett) stated that from the observations of himself and others, the Old Red sandstone or the Catskill formation, did not occur within the State of New York.

A review of the ground during the following year (1863) convinced me that the observations on which this conclusion was based, had been conducted along the line of an eroded anticlinal valley; and that the red rock of the Catskill formation occupied the higher portions of the country on either side. Having made geological sections across this part of the country in 1844, I saw nothing on this review to conflict with the observations made at that time; but as the lines of section had been carried southward from the Mohawk, they had extended only to the higher portions of country in the range of the Catskills; and these elevated outcrops, of which several are visible on looking from the north, proved to be, as I had before asserted, synclinals, preserving the red shales and sandstones in their upper members. This structure, however, left the broader valleys exhibiting the outcropping edges of the strata of the Chemung and Portage groups, which are here not separable from each other by any well marked limitation of either lithological or palæontological evidence.

It became apparent, therefore, that no true representation of these strata could be made upon a map, without first having a careful survey of the country, and tracing and locating the outcrops upon township-plats, the best means at our disposal, and then combining the whole on a larger map.

A visit to the Catskill mountains in 1857, also satisfied me that the higher part of the range on the south of the Clove (and to some extent on the north of this gorge) was composed of higher rocks than those referred to the Catskill or Old Red sandstone, which latter had been first recognized near Blossburg in the northern part of Pennsylvania, by its numerous remains of Holoptychius.

Therefore, while we had sufficient evidence of the occurrence of old red sandstone in the Catskill mountain range, we had not that knowledge which was requisite for its proper and satisfactory illustration upon a geological map. In order to set at rest this question and to be able to present the real expression of this formation upon a map of the State, Mr. Sherwood was employed to carry out the proposed investigation.

I may mention a few of the general results. The red sandstone or Catskill formation, has been traced from its wider extension in Pennsylvania northward into New York, at several points along the border to the west of the Catskill range. The same rocks have been traced in several synclinals far into the State, in Greene and Chenango counties. On the eastern face of the Catskills, in the gorge known as the Clove, the same beds have been recognized charged with the remains of Holoptychius, similar to those of the beds near Blossburgh, Pa., and elsewhere.

These red shaly and marly beds, in alternations with sandstone of more than 200 feet in thickness, carry these Ichthyic remains in the form of fragments of bony plates, scales, etc., and remind one strongly of the same beds on the northern outcrop of the formation in Tioga county, Pennsylvania.

We have had for some time a nearly entire form of Holoptychius in the collections of the State Museum, from Delaware county, and specimens of scales from the same region.

Not only do we find these fish-beds so well marked in the eastern outcrop, but we see the red beds passing upward into mottled gray, and generally succeeded by sandstone and conglomerate in alternating beds, the coarser materials increasing as we ascend, until the higher part of the mountain becomes chiefly composed of gray sandstone and conglomerate—the highest exposure giving us 440 feet of coarse gray sandstone and conglomerate to the summit of Round Top.

On comparison of observation elsewhere made, it seems pretty well determined that at least the upper 900 feet of the Catskill mountains consist of strata belonging to a higher member of the series, No. X, or the Vespertine formation of the Pennsylvania Survey.

It has also been ascertained, that in addition to the occurrence of this formation in the Catskill mountain region and in the synclinals extending thence to the southwest, it occurs in two other synclinals in the western part of Delaware county; and we shall probably be able to show that it extends into the State of New York, at one or more points in the south-western counties, where it is underlaid by the Catskill formation.

In the eastern part of the State there are no strong lines of demarcation between the formations, such as may be recognized in its central portion and elsewhere. Bands of red rock occur at the horizon of the Portage group; and in my report of last year I communicated the fact that a band of gray sandstones with characteristic Chemung fossils, had been found at a point 150 feet above the base of the red rocks which were essentially non-fossiliferous, and which had heretofore been referred to the Catskill formation.

The section measured from Palenville, in Greene county, to the top of Round Top Mountain, gives an entire thickness of nearly 3,800 feet; the fish remains beginning at a point sixty-two feet above the base of section, and continuing for over two hundred feet; there being still 3,500 feet of rock without recognized fossils.

Prof. H. D. Rogers has given the maximum thickness of Formation IX (the Catskill formation) at 6,000 feet; while its average thickness along the Alleghany mountains is given at 2,000 feet. The maximum thickness of No. X (the Vespertine) as given by the same author, is 2,000 feet.

It will require further examination of the series in the region of the southern part of the Catskill mountains, to determine a satisfactory line of demarcation between the two formations. The question, however, of the outer limits and extension of the Catskill formation in the State of New York, has been essentially determined by this investigation.

In conclusion, I would beg leave to repeat what I said in my Report of last year, viz.: that it is quite time that similar careful investigations should be commenced in other parts of

the State, and especially along the junction of the Lower fossiliferous rocks with the crystalline formations; and also among the crystalline formations themselves, of which we know very little beyond their general geographical distribution and exterior limitation.

I am, very respectfully,
Your obd't servant,
JAMES HALL.

ADDITIONS TO THE STATE MUSEUM

DURING THE YEAR 1874.

I. ZOÖLOGICAL.

I. By Donation.

Ophioglypha bullata Wyville Thomson, dredged May 27, 1873, from 2,650 fathoms, bottom gray ooze. Lat. 34° 51′ N.: Long. 63° 59′ W.

Caryophillia borealis var. and *Deltocyathus Agassizi* Pourtales, dredged, together with about sixty other specimens mostly in the living condition, from 1,090 fathoms, July 10, 1873. Lat. 37° 26′ N.: Long. 25° 14′ W.

Sand, composed of larger Foraminifera, Orbulina, etc., from 60 fathoms. St. Jago, Cape Verdes.

Material from dredge, Sept. 9, 1873, Lat. 8° 37′ S.: Long. 34° 28′ W. 615 fathoms.

Sounding, Feb. 26, 1873, Lat. 23° 23′ N.: Long. 35° 10′ W. 3,150 fathoms.

Sounding, Sept. 30, 1873, Lat. 20° 13′ S.: Long. 35° 19′ W. 2,150 fathoms.

Sounding, Oct. 11, 1873, Lat. 35° 41′ S.: Long. 20° 55′ W. 2,025 fathoms.

Sounding, Oct. 23, 1873, Lat. 35° 59′ S.: Long. 1° 34′ E. 2,550 fathoms.

Sounding, Oct. 25, 1873, Lat. 36° 22′ S.: Long. 8° 12′ E. 2,650 fathoms.

Sounding, Oct. 28, 1873, Lat. 35° 0′ S.: Long, 17° 57′ E. 1,250 fathoms.

From H. N. Mosely, of H. M. ship Challenger, through Hon John A. Dix.

An albino mink — *Putorius vison* (Linn.). From G. C HALL, Greenbush, N. Y.

A red mouse — *Hesperomys Nuttalli* Baird (Mammals of America, p. 467). From IRA SAYLES, Canisteo, N. Y. Specimen captured in Christiansville, Mecklenburgh Co., Va.

A young specimen of the tawny meadow-mouse — *Arvicola rufescens* DeKay. From B. S. MESICK, Claverack, N. Y.

A violet-colored salamander — *Salamandra violacea* Barton. Specimens of queen-cells of the honey-bee *Apis mellifica*. From Rev. J. L. ZABRISKIE, New Baltimore, N. Y.

A hellgramite fly — *Corydalis cornuta* (Linn.). From HOWARD TREADWELL, Albany, N. Y.

A spectre bug — *Diapheromera femorata* (Say). September 4th. From BERNARD GLOECKNER, Albany, N. Y.

Two living dipterous "rat-tail" larvæ, probably *Eristalis* sp. July 23d. From C. L. G. BLESSING, Slingerlands, Albany Co., N. Y.

A scorpion brought from the South in paper-rags to C. Van Benthuysen & Sons. From J. WARREN CUTLER, Albany, N. Y.

A Luna moth — *Actias Luna* (Linn.), captured June 17th. From FRANK MUNSELL, Albany, N. Y.

A myriapod — *Cermatia forceps* Rafin. November 6th. From W. RYAN, Albany, N. Y.

A brook trout — *Salmo fontinalis* Mitch., weight 4½ lbs., length 20⅞ in., circumference at anterior portion of first dorsal fin, 12 inches. Captured in a pond in St. Lawrence Co., N. Y., emptying into Bog River near Graves Mountain. From W. W. HILL, Albany, N. Y.

Two specimens of the banded gar-fish — *Belone truncata* Lesueur, taken in the Hudson river, near the lock at Albany. From WILLIAM LEONARD and S. G. FISHER.

Specimens of *Teredo navalis* Linn., taken alive from the timbers of the U. S. frigate Congress, sunk by the Merrimac in Hampton Roads; also a polished section of the perforated timber. From WM. J. MCALPINE, Albany, N. Y.

A cat having the fore-legs only — a year old at its death. The skeleton added to the Museum collection. From WILLIAM W. DURFEE, Gloversville, N. Y.

A hoary bat — *Vespertilio pruinosus* Say. From VERPLANCK COLVIN, Albany, N. Y.

A pine grosbeak — *Pinicola enucleator* (Linn.), from flocks feeding on the berries of the mountain ash (*Pyrus Americana*), during November and December, in New Scotland, Albany county, N. Y. From JOHN S. MOAK, New Scotland.

An entozoön from a cat. From CHARLES DEVOL, M. D., Albany, N. Y.

A photograph of a muskalonge — *Esox estor* (Linn.), taken July 2, 1869, in the St. Lawrence river, near Clayton, N.Y., of the length of 4 feet 7½ inches, and circumference of 25¼ inches. From ELISHA W. HOPKINS, Little Falls, N. Y.*

Tusks, 6¾ inches in length, of a domestic hog — *Sus scrofa* Linn., ♀, killed at Cohoes, N. Y. From F. A. CLUTE, Schenectady, N. Y.

A piece of a bone, two inches in diameter, imbedded in the trunk of a hemlock tree, near its center, two feet below a branch, and forty-five feet from the ground, the trunk at the point having a diameter of twenty inches. Chittendon, Vt. From HENRY SPAWN, Albany, N. Y.

Skull, feet and leg bones, vertebræ and ribs, and skin of a Peccary. Lower jaw bones of a large Wolf. Skull of a Bear. Two skulls of Racoons. Opossum skull (not complete). Skeleton of a large Crane. Carapace and plastron of a Turtle. Teeth and bones of various animals. Fishes,

* Another muskalonge captured by Mr. Hopkins at the same locality, measured 4 feet 11½ inches in length, 27 inches in circumference, and weighed 42½ pounds.

Snakes, Horned toads, Turtles, Scorpions and Insects in alcohol, collected in Texas. From C. E. HALL, Albany, N. Y.

A dried toad (imperfect) — *Bufo Americanus* Le C. From RUTH M. TITUS, Preston Hollow, N. Y.

Ten skulls and three mounted feet of mammals and birds, as follows:

Vulpes fulvus Rich. Red Fox. Skull.
Felis domestica Linn. Domestic Cat. Skull.
Sciurus Hudsonicus Harl. Red Squirrel. Skull.
Sciurus Carolinensis Gm. Gray Squirrel. Skull.
Arctomys monax (Linn.). Woodchuck. Skull.
Fiber zibethicus Cuv. Muskrat. Skull.
Mus decumanus Pallas. Common Rat. Skull.
Lepus nanus Schr. Gray Rabbit. Skull.
Sus scrofa Linn. Domestic Hog. Foot.
Cervus Virginianus Penn. Red Deer. Foot.
Syrnium nebulosum Gray. Barred Owl. Skull.
Corvus Americanus Aud. Crow. Skull.
Meleagris gallopavo (Linn.). Domestic Turkey. Foot
From J. W. HALL and C. E. HALL, Albany, N. Y.

II. By Collection.

A horse mackerel — *Orcynus secundi-dorsalis* Storer — measuring 9 feet 9 inches in length. (The skin stuffed and mounted, and parts of the skeleton preserved.) Cape Cod Bay.

Skeleton of a horse mackerel. (Prepared and mounted by Prof. H. A. Ward, of Rochester, N. Y.) Cape Cod Bay.

Mactra solidissima Chemn., *Solen ensis* Linn., *Busycon canaliculata* (Linn.), and other shells from Cape Cod Bay and Penikese Island: in alcohol.

Collection of Prof. JAMES HALL.

Pandora trilineata Say, and *Loligo brevipinna* Lesu., from Penikese Island: in alcohol.

Libinia canaliculata Say (spider crab), *Cancer irroratus* Say (sand crab), and *Lepas fascicularis* Ell. and Soland. dried and in alcohol. Penikese Island.

Platyonichus ocellatus Herbst. sp., dried: *Asterias arenicola* Stimp., in alcohol. Buzzard's Bay.
Tautoga Americana, in alcohol. Penikese Island.
Collection of C. E. HALL, Albany, N. Y.

Specimens of insects and their operations:
Eggs of *Platysamia Cecropia* (Linn.), and of *Ixodes bovis*.
Larvæ of *Eacles imperialis* (Drury), young, and *Alypia octomaculata* (Fabr.).
Pupæ of *Orgyia leucostigma* (Sm.-Abb.), and *Datana ministra* (Drury).
Poplar-stem gall of *Pemphigus populicaulis* Fitch.
Cone-like spruce gall of *Adelges* ——— ?
Solidago gall of *Gelechia gallæsolidaginis* Riley.
Oak gall of *Hamadryas Bassetella* Clem.
Maple leaf cut by *Ornix acerifoliella* Fitch.
Burrows under cedar bark of *Hylurgus dentatus* Say.
Collection of J. A. LINTNER.

A whip snake, puff adder, corn snake, two water moccasins, pilot snake, a large tree lizard and several smaller ones of two species, sea and land birds, craw-fish and other crustaceans, and numerous insects. (Not yet arranged in the collections). Collection of J. W. HALL.

III. By Purchase.

Two walruses — *Trichicus rosmarus*, an adult female and young. Baffin's Bay.

II. BOTANICAL.

I. By Donation.

Section of a branch, with leaves and berries of *Celtis occidentalis* Linn. (hackberry), taken from the "unknown tree" on the N. Y. Central Railroad, near Spraker's Basin, 53 miles from Albany. From O. J. STAFFORD and E. H. VEDDER, Canajoharie, N. Y.

Section of a locust tree (*Gleditschia triacanthos* L.) with an imbedded thorn. Two species of Fungi. From Prof. JAMES HALL.

Specimen of *Cladastris tinctoria* — yellow-wood, from Kentucky.

A polished section of *Maclura aurantiaca* — Osage orange.

Specimens of *Platycerium alcicorne* Gaud. and *Cucurbitaria seriata* Pk. From C. DEVOL, M. D., Albany, N. Y.

Two species of Lichens. From Miss M. L. WILSON, Buffalo, N. Y.

A Fern and three species of Fungi. From Mrs. L. A. MILLINGTON, Glens Falls, N. Y.

Twenty species of southern Plants. From Mrs. E. E. ATWATER, Chicago, Ill.

Specimens of *Sedum reflexum* L. From Rev. H. WIBBE, Oswego, N. Y.

Six species of Fungi. From Rev. J. L. ZABRISKIE, New Baltimore, N. Y.

Two species of Fungi. From Prof. C. E. BESSEY, Ames, Iowa.

Five species of flowering Plants. From Prof. A. N. PRENTISS, Ithaca, N. Y.

Ten species of Plants, mostly Fungi. From E. C. HOWE, M. D., Yonkers, N. Y.

Two species of Lichens. From H. WILLEY, New Bedford, Mass.

Specimens of *Centaurea nigra* L. From R. KERSTING, Yonkers, N. Y.

Four species of Plants, three of them Fungi. From H. A. WARNE, Oneida, N. Y.

Specimens of *Habenaria leucophæa* Nutt. From E. L. HANKENSON, Newark, N. Y.

Eight species of Fungi. From W. R. GERARD, Poughkeepsie, N. Y.

Specimens of *Lygodium palmatum* Sw. From J. T. LOCKWOOD, Hunter, N. Y.

Three rare Carices and *Botrychium matricariæfolium* A. Br. From B. D. GILBERT, Utica, N. Y.

Specimens of *Amarantus spinosus* L. From M. RUGER, New York City.

Specimens of *Ustilago Montagnei* v. *major* Desm. From E. S. MILLER, Wading River, N. Y.

Forty-seven species of Fungi. From J. B. ELLIS, Newfield, N. J.

Twelve species of Plants. From C. F. AUSTIN, Closter, N. J.

Two species of Fungi. From C. C. PARRY, Davenport, Iowa.

Fourteen species of Plants. From T. M. PETERS, Moulton, Ala.

Forty-five species of Fungi. From Hon. G. W. CLINTON, Buffalo, N. Y.

II. By Exchange.

Thirty species of rare Flowering Plants. From J. M. CONGDON, East Greenwich, R. I.

III. By Collection.

One hundred and sixty species of Plants, mostly Fungi. By the Botanist, CHARLES H. PECK.

III. GEOLOGICAL AND MINERALOGICAL.

I. By Donation.

A block ($10\frac{1}{2}$x6x3) of sileceous Sandstone, sand rubbed with edges beveled. No. 160 in Economic collection. Fulton, Schoharie county, N. Y. From J. M. SCRIBNER, Middleburgh, N. Y.

Two slabs of Potsdam Sandstone, containing *Lingulepis pinnaformis* (Owen). From Falls of St. Croix, Minn. Collection of Prof. JAMES HALL in 1865.

A weathered block of Corniferous Limestone, containing numerous specimens of Spirifera, Orthis, Atrypa, Corals, etc. Collected for the Museum.

Spirifera———? from the Cauda-Galli Grit, near Cobleskill, N. Y. From CHARLES CALLAWAY, Albany, N. Y.

A rolled mass of calciferous Sandstone, with Fucoids weathered from its surface. From O. H. CROMWELL, Saratoga Springs, N. Y.

Conglomerate. Locality? From MICHAEL MILLER, Lansingburgh, N. Y.

A block of limestone bearing glacial scratches, taken from a well at No. 259 Central avenue, Albany, from a depth of 43 feet in the blue clay.

Three concretionary forms from a sand hill 40 feet below the surface. From L. R. BOYCE, M. D., Albany, N. Y.

Specimen of Espenhain's Hydraulic Cement rock. From E. ARMSTRONG, Fayetteville, N. Y.

A globular mass of Iron Pyrites from soil 47 feet beneath the surface, south of Park avenue, Albany. From JAMES BRIERTON, Albany, N. Y.

Two claystones of remarkable forms (imitative), from near the Albany Penitentiary. From J. M. NORTHRUP, Albany, N. Y.

Coal — Lignite, from Disco, Greenland, Lat. 69° 45′ N.: Long. 52° 20′ W. Juniata Expedition, 1873. From Prof. D. S. MARTIN, Rutgers Female College, New York.

A piece of Plymouth Rock. From HENRY HURDIC, Pittsburg, Penn.

Crystals of Calcite, and large cubic crystals of Iron Pyrites in mica slate, from Chittenden, Vt. From L. D. SMITH, West Winfield, Herkimer Co., N. Y.

Three specimens of Plumbago, from the Plumbago mine at Ticonderoga, N. Y. From Hon. ROBERT S. HALE, Elizabethtown, N. Y.

Specimens of Brazilian topaz. From Hon. ALEX. T. JOHNSON, Utica, N. Y.

A photograph of *Eurypterus Dekayi* Hall, from quarries of B. Miller & Son, Williamsville, N. Y., — the original in the Buffalo Society of Natural Sciences. From ED. B. MILLER.

Rose Quartz from Essex Co., N. Y.

Calciferous Sandstone, containing Ophileta. From H. H. INGOLSBE, S. Hartford, Washington Co., N. Y.

Cannel Coal from Ohio, containing plant remains. From AMASA J. PARKER, Jr., Albany, N. Y.

IV. ARCHÆOLOGICAL AND ETHNOLOGICAL.

By Donation.

An Indian skin-dresser. From H. H. INGOLSBE, South Hartford, Washington Co., N. Y.

An old hammer, bearing date of 1771. From DIEDERICH TREMPER, Valatie, N. Y.

A brick from the bake oven of Fort Ticonderoga. From J. W. CLEMANS, Albany, N. Y.

A perforated stone implement (aboriginal) found on Mr. Seely's farm at Cedar Hill. From R. J. HUBBS.

Three flint Indian arrow heads and a scraper, from Lake Co., Ill. From D. R. WILLIAMS.

Indian stone implements, flint arrow heads, Indian jaw, arm and leg bones. Collected in Texas. From C. E. HALL, Albany, N. Y.

V. TO THE LIBRARY.

I. By Donation.

Descriptions of Bryozoa and Corals of the Lower Helderberg Group. By James Hall. Published May, 1874, in advance of the 26th Report on the N. Y. State Museum of Natural History. 8vo., pp. 24.

Descriptions of New Species of Goniatitidæ. With a List of previously described species. By James Hall. Printed May, 1874, in advance of the 27th Annual Report on the N. Y. State Museum of Natural History. 8vo., 4 pp.

Report on the United States and Mexican Boundary Survey, by Wm. H. Emory. Vol. I, Part II, [comprising] Geological Reports of Dr. C. C. Parry and Assistant Arthur Schott.— Notes by Wm. H. Emory. — Palæontology and Geology of the Boundary, by James Hall. — Description of Cretaceous and Tertiary Fossils, by T. A. Conrad. — Washington, 1857. Quarto, pp. 174, plates 21. From Prof. JAMES HALL.

Annual Report of the Commissioner of Agriculture and Public Works for the Province of Ontario, on Agriculture and Arts, for the year 1872. Toronto, 1873. 8vo., pp. 511.

Catalogue of Minerals, with their Formulæ and Crystalline systems, prepared for the use of the Students of the School of Mines of Columbia College. By Thomas Egleston. New York, 1871. Pamph., 8vo., pp. 41. From the AUTHOR.

The Geological and Natural History Survey of Minnesota. The second annual report for the year 1873. Saint Paul, 1874. Pamph., 8vo, 219 pp. From Prof. N. H. WINCHELL, State Geologist.

Auditor of Accounts' Annual Report of the Receipts and Expenditures of the city of Boston and the county of Suffolk, State of Massachusetts, for the financial year 1873–74. Boston, 1874. From ALFRED T. TURNER, Auditor.

Fifth Annual Report of the Geological Survey of Indiana, made during the year 1873, by E. T. Cox, State Geologist, assisted by Prof. John Collett, Prof. W. W. Borden, and Dr. G. M. Levette. Indianapolis, 1874, 8vo, pp. 494 and 4 maps. From Dr. G. M. LEVETTE.

Sixth Annual Report of the Trustees of the Peabody Academy of Science, for the year 1873. Salem, 1874. Pamph., 8vo, pp. 114. From the ACADEMY.

Bulletin de la Société des Sciences Historiques et Naturelles de L'Yonne. Année 1873, 27e volume; Année 1874, 28e volume. Auxerre, 1873, 1874. From the SOCIETY.

Myriapoda Nova Americana, auctoribus A. Humbert et H. de Saussure. — Extrait de la Revue et Magasin de Zoölogie. (Mat 1870.) Pamph., 8vo., pp. 10. From the AUTHORS.

Carcinologiske Bidrag til Norges-Fauna af G. O. Sars. I. Monographi over de ved Norges Kyster forekommende Mysider. Andet Hefte. med 3 Pl. Christiania, 1872. Quarto, pp. 32.

Bidrag til Kundskaben om Christianiafjordens Fauna. III. Væsentlig udarbeidet efter Prof. Dr. M. Sars's efterladte Manuscripter ved G. O. Sars. Christiania, 1873. 8vo., pp. 88, plates 5.

On some Remarkable Forms of Animal Life, from the Great Deeps of the Norwegian Coast. I. Partly from Posthumous Manuscripts of the late Professor Dr. Michael Sars. By George Ossian Sars. With 6 copperplates. Christiana, 1872. Pamph., quarto, pp. 82.

From DET KONGELIGE NORSKE UNIVERSITET I CHRISTIANIA.

Bulletin de la Société Impériale des Naturalistes de Moscou. Année 1873. No. 2. Moscou, 1873. Pamph., 8vo. From the SOCIETY.

Bulletin du Jardin Impérial de Botanique de St. Pétersbourg. Tome I, Part II; Tome II, Parts I, II. St. Pétersbourg, 1872, 1873. Pamphlet, 8vo. From E. R. DE TRAUTVETTER, Director.

K. F. Köhler's Antiquarium in Leipzig. Catalog No. 256, 1874. Catalog No. 257, 1874. Two pamphs., 8vo., pp. 30, 90. From K. F. KÖHLER.

Les Cristalloïdes Complexes a sommet étiolé, par Le Cte. Leopold Hugo. Paris, 1872. Pamph., 8vo., pp. 24.

Essai sur la Géométrie des Cristalloïdes, par Le Cte. Leopold Hugo. Paris, 1873. Pamph., 8vo., pp. 20.

Une Réforme Géométrique. Introduction a la Géométrie descriptive des Cristalloïdes, par Le Cte. Leopold Hugo. Paris, 1874. Pamph., pp. xii+19.

From the AUTHOR.

Sitzungs-Berichte der naturwissenschaftlichen Gesellschaft Isis in Dresden. Jahrgang 1873, April – Decem. Jahrgang 1874, Jan. – Mch. From the SOCIETY.

II. By Purchase.

Traité de Paléontologie Végétale ou la Flore du Monde Primitif dans ses Rapports avec les Formations Géologiques et la Flore du Monde Actuel, par W. Ph. Schimper. Tome troisième. Paris, 1874. Atlas cinquième et sixième livraisons, avec les planches xci a cx. Quarto, Paris, 1874.

Spécies Général et Iconographie des Coquilles vivantes, comprenant la Collection du Muséum d'Histoire naturelle de Paris, Par L.-C. Kiener continué par le docteur P. Fischer. Famille des Turbinacées. Paris, 1873. 8vo., p. 128, plates 42.

The American Journal of Science and Arts. New Haven, Conn., 1874. Third series. Vols. VII and VIII.

The American Naturalist. Salem, Mass., 1874. Vol. VIII.

Bulletin of the Buffalo Society of Natural Sciences. Vol. I, No. 4; Vol. II, Nos. 1, 2 and 3. Buffalo, N. Y., 1874.

United States Railroad and Mining Register. Philadelphia, 1874. Vol. XVII. Folio.

Annual Record of Science and Industry for 1871. Edited by Spencer F. Baird. New York, 1872. 12mo.
Do. for 1872. New York, 1873.
Do. for 1873. New York, 1874.

Asher and Adams' New Statistical and Topographical Atlas of the United States. New York [1874]. Two vols., folio.

The Albany Directory for the year 1874. Albany, 1874.

ADDITIONS TO THE MUSEUM IN PREVIOUS YEARS OMITTED, AND CORRECTIONS TO FORMER REPORTS.

A porphyry axe, 7x3 inches (original number 17470) probably from northern Europe, presented to the State Cabinet during the Curatorship of E. Jewett, 1857-1865, by the Hon. W. DE REAASLOFF, Chargés d' Affaires of Denmark.

A piece of fossil wood, 18x8 inches, from California. From Hon. CHARLES P. DALY, N. Y.

In the 12th Report on the State Cabinet, p. 109, Benjamin Marsh, Esq., of Albany, is credited with a "section of a Petrified Tree from Arizona." A portion preserved (about three-fourths) of apparently, the original label of the specimens, bears the following:

This piece of petrified
from a Mining Claim, 350
surface of the earth at Bal
colony of Victoria, Australi
San Francisco, by Professor
Wizard, and presented to the
and by the proprietors of the
presented to W. C. Smith, Es

The specimen has accordingly been relabeled in accordance with the above record, as from Victoria, Australia.

In the 20th Annual Report on the State Cabinet, p. 388, line 4 of foot-note, the genus Syringothyris is inadvertently given as Lysingothyris.

In the 23d Annual Report the following corrections are to be made in the list of Echinodermata, pp. 22 and 23:

Page 22, line 34, for *Cropaster* read *Crossaster*.

Page 22, line 39, for *Stichaster albulus* read *Stephanasterias albula*.

Page 23, line 5, for *parnia* read *parma*.

Page 23, line 6, for *Desbachiensis* read *Dröbachiensis;* (recently referred by A. Agassiz to the genus Strongylocentrotus.)

In the 24th Annual Report on the State Museum, p. 24, in the donation credited to Hon. Ezra Cornell, the fossils recorded as *Spirifera Verneuili* Murch, should be *Spirifera mesastrialis* Hall.

In the 25th Annual Report, p. 19, in lines 11 and 12, for N.Y. read Vermont.

REPORT OF THE BOTANIST.

S. B. Woolworth, LL.D.,

Secretary of the Board of Regents of the University.

Sir — Since the date of my last report, specimens of one hundred and fifty species of plants have been mounted and placed in the Herbarium of the State Museum of Natural History, of which one hundred and thirty were not before represented therein. A list of the specimens mounted is marked (1).

Specimens have been collected in the counties of Albany, Dutchess, Fulton, Greene, Hamilton, Oswego, Rensselaer and Saratoga. These represent one hundred and sixty species new to the Herbarium, seventy of which are regarded as new or hitherto undescribed species. A list of the specimens collected is marked (2).

Specimens of fifty-six New York species, new to the Herbarium and not among my collections of the past season, have been contributed by or been obtained in naming specimens for correspondents. These added to the collected species make the whole number of additions two hundred and sixteen, a number considerably in excess of that for the previous year. A list of the contributors and their contributions is marked (3).

New species with their descriptions, previously unreported species, new stations of rare plants, etc., are given in a section marked (4).

CLASSIFIED TABULAR STATEMENT.

		New to the Herbarium.	New to science.
Plants collected,	Flowering plants	3	....
	Algæ	3	....
	Fungi	154	70
Total		160	70
Plants contributed,	Flowering plants...	5	....
	Mosses	2	....
	Lichens...........	3	....
	Fungi	46	13
Total		56	13
Collected and contributed		216	83

In my last report allusion was made to the fact that the spruce trees in some parts of the great northern wilderness, were said to be dying at an unusual rate as if affected by some fatal disease. In the absence of any personal knowledge of the circumstances or conditions attending the destruction of these trees, the attacks of fungi, the attacks of insects and the effects of drought were suggested as possible causes, chiefly for the purpose of directing the attention of those who might have the opportunity of an investigation, in such directions as seemed most likely to afford a satisfactory explanation of the mystery. It was then my impression that the trouble was of comparatively recent date and that it was possibly due to the modification of our climate by reason of the extensive and rapid denudation of our forest lands.

But I find that it is no new thing, that years ago lumbermen were fully aware of the pecuniary loss they were sustaining from this timber malady. Mr. Henry Hough, in answer to my inquiries, writes from Lewis county thus: "The dying of the spruce in this section has mostly, if not entirely, ceased. The greatest destruction on our territory was from ten to fifteen years ago." In Rensselaer county the same trouble was experienced about thirty years ago. A lumber firm found that their spruce timber was rapidly dying, and to make their

loss as light as possible they made haste to open roads in the forest that they might draw out and work up as many dead spruces as practicable before decay should render them entirely worthless. But with all their promptness they suffered no inconsiderable loss, for these dead trees soon became too much decayed to make marketable lumber.

I have asked lumbermen and others who have been aware of the destruction of the spruces, what theory they held in respect to the cause of it. Their theories are various, but the most prevalent attribute it to excessive dry weather or to the agitation of the trees by high winds. The few observations that I have been able to make lead me to adopt a theory quite different from these, and though the discussion of it belongs rather to the province of the entomologists than of the botanists, such is the importance of the subject that I cannot withhold a brief account of my investigations and conclusions.

In August a collecting trip was undertaken in the vicinity of Lake Pleasant, Hamilton county. While there it became apparent to me that I was in a region where the spruces were dying. Standing near the outlet of the lake and looking upon the distant mountain slopes toward the north-east, east and south, patches of brown appeared here and there mingled with the usual dark green hue of the forest. The inhabitants told me that these brown patches were groups of dead spruces; that the spruce trees were then rapidly dying, and had been for two or three years previous, and that in consequence the value of the woodland was greatly diminishing. One of the most conspicuous of these brown patches was on the slope of Speculator Mountain, a little more than half way from the base to the summit. Preparations were therefore made to visit this locality. Once on the ground it needed but little observation to satisfy me that the destructive process was then in operation. The ground under some of the spruces was thickly strewn with their fallen leaves, yet green, and every agitating wind was bringing down more of them. The bark of these trees, and of others already dead, was perforated in many places with small round holes scarcely one-eighth of an inch in diameter. Upon stripping a piece of bark from the trunk of one of the affected trees, the apparent cause of the mischief was at once revealed. The surface of the wood and the inner layers of the bark were abundantly furrowed by

the winding and branching galleries of a small bark-mining beetle, an insect known to entomologists as the *Hylurgus rufipennis* Kirby, though the wings are by no means always red, as the name would indicate. Both the mature insect and its larvæ occurred in countless numbers under the bark of the dying and recently dead trees. In a single instance they were accompanied by a much smaller beetle of similar shape and habits, the *Apate rufipennis* Kirby,* but the former is evidently the chief agent in this unprofitable business. These insects excavate their passages between the bark and the wood, eating away a part of both. Their extended work is, therefore, equivalent to a girdling of the tree. Their numerous galleries form an intricate network of furrows on all sides of the trunk, and traverse one of the most vital parts of the tree, the newly formed and forming layers of wood and bark. The furrows are shallow on the surface of the wood, rather more than half their diameter being in the bark, but their effect is to interrupt the circulation of the nutrient juices, and finally to destroy all vital action. The perforations in the bark, by admitting moisture, doubtless work more or less injury. The surface of the sapwood and the corresponding inner surface of the bark of living trees are discolored for a short space on both sides of the furrows, as if the injury exerted a poisonous or deadening influence on the tissues in its immediate vicinity. This was clearly seen in a tree which had been but slightly injured, there being but few furrows, and these merely longitudinal ones without lateral branches. Each occupied the center of a discolored stripe about half an inch broad, but which usually extended from two to four inches up and down beyond the extremities of the furrows. In another tree there were groups of furrows separated by considerable intervals, the central portions of which intervals had a whitish fresh appearance when the bark was first peeled, but after a few moments' exposure to the air the whole surface of the wood had changed to a dull, dead brown color, indicating a diseased or unnatural condition of the surface tissues. The foliage on this tree had not yet lost the green hue of life, but had commenced falling to the ground.

Small trees are rarely attacked. In the localities visited,

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* I am indebted to Messrs. *J. A. Lintner* and *J. L. Leconte* for the entomological names of these insects.

from one-half to two-thirds of the spruces with a basal diameter ranging from one to two feet were either dead or dying. Trees of this size are the most suitable for lumber and consequently the most valuable. The smallest affected tree noticed, had an estimated basal diameter of about ten inches. In this case the attack appeared to be a failure, for so much resin had oozed from the wounds that the work was obstructed. The galleries were scattered and single and their authors were found dead, each in its furrow. No larvæ were present, and the apparent attempt to establish a colony in this tree had thus far failed. But it may be that this tree had only been attacked for the purpose of obtaining food, and had not yet been brought into that sickly, languishing condition thought by some entomologists to be necessary to induce the establishment of a colony, the deposition of eggs and the development of larvæ. For it is said of *Scolytus destructor*, a bark-mining beetle that sometimes proves very destructive to elm trees in Europe, that the adult insects first attack healthy trees for the purpose of obtaining food, and when, by this means the vigor of the tree has become somewhat impaired, the female deposits her eggs in her galleries. Then the rapidly increasing numbers soon destroy the life of the tree.

When two trees of unequal size stand in close proximity the larger one seems to be most liable to be attacked. In one instance two trees stood scarcely more than three feet apart. The larger one had been attacked; the smaller remained unharmed. In another similar instance the larger of the two trees was dead, having been attacked first; the other was dying. Why this preference on the part of these insects for the largest trees? It may be that young trees are apt to be too resinous to be attacked successfully. In the case of the small tree already mentioned the gummy exudations from the perforations in the bark first attracted my attention. Or the insects may instinctively know that a tree with a large trunk presents a broader field for their operations than one with a small trunk; or possibly the vigor of the tree may be so impaired by age that it is more readily brought into suitable condition for the habitation of these parasites. Whatever the cause of this selection, no diseased condition of the trees was detected except that which was accompanied by and to all appearance was directly due to the insects themselves. Cer-

tainly if the tree is at all diseased before its attack, the insects must be exceedingly quick to detect it, else they could not be found in abundance in trees whose leaves are yet green and whose sapwood is yet fresh and moist, except where stained by their excavations.

In the vicinity of Lake Pleasant the affected trees are upon the mountain slopes or on dry ridges where the spruces are especially abundant. And we might naturally expect that the insects would be attracted to and carry on their depredation most extensively in those localities where the material on which they work is most abundant. In the valleys I saw no trees affected by them and yet they doubtless do carry on their destructive work in the low lands where spruces abound. I see no reason why they should not.

In some localities their ravages have already ceased. On the slopes of an elevation a few miles southwest from Speculator Mountain there are two groves of dead spruces. Many trees in both were examined and, though all the dead ones bore unmistakable marks of the former presence of the beetle, not one could now be found either in the adult or in the larval state. What had caused them to disappear? Surely not the lack of material on which to work, for several large living spruces yet remained. This leads to the consideration of remedies. Doubtless there are natural agencies whose free operation has a tendency to check the ravages of these insects and to prevent their excessive multiplication, but there are times and localities in which these opposing agencies are inefficient or inoperative, and then these destructive insects multiply rapidly and their ravages become painfully apparent. It is then necessary that man himself should do something to protect his property from these active little foes. It was noticeable that many of the dead trees, in the two groves just mentioned, had their bark so chipped by wood-peckers that the general hue of the trunk was a reddish-brown instead of the usual grayish-brown. Here then is a possible explanation of the cessation of the ravages and the absence of the insects. Here is doubtless the indication of one of natures antidotes to the mischief. The wood-pecker is the natural foe of such insects. With its long beak and barbed tongue it extracts them as a dainty morsel from beneath the bark. It is quite probable that these birds had congregated in these two localities in sufficient numbers to completely stop the ravages of the insects.

A few were seen at work on the affected spruces of Speculator Mountain, and if not interrupted they will probably in due time succeed in checking the ravages here also. The protection of these birds is to be enumerated among the means to be employed in checking the malady of the spruces. They are the friends of the forest and the allies of man. How insignificant the insect yet how capable of injury. How lightly we esteem the wood-pecker yet how indispensable are his services.

A remedy employed in similar cases in Europe is to cut down the affected trees, strip off their bark and burn it with its destructive tenants. Though it is somewhat doubtful if the owners of large tracts of timber land can be induced to adopt this method of checking the destruction of their spruces, it is certainly to be recommended. The loss from its omission would soon far exceed the cost of its employment, but care should be taken not to engage in this work in a dry time lest the destruction from forest fires should be greater than that from insects.

A brief extract from the Entomology of Kirby and Spence will show that the ravages of insects upon forest trees in Europe have sometimes been serious, and that it is none too soon for us to note well what is transpiring in our own forests.

"The bark-borer of the oak is a small beetle of an allied genus, *Scolytus pygmæus* which with us does no great harm, but so abounded of late years in the Bois-de-Vincennes, near Paris, that 40,000 trees were killed by it; and many of the finest elms in St. James' Park and Kensington Gardens as well as in the promenades of various cities in the north of France, have fallen victims to another of this tribe, *Scolytus destructor*, whose trivial name well characterizes the frequency and severity of its ravages. The ravages of *Tomicus typographus* in the pine forests of Germany, have long been known under the name *Wurmtrökniss* (decay caused by worms), and they sometimes attack the inner bark in such numbers, 80,000 being sometimes found in a single tree, that they are infinitely more noxious than those insects that bore into the wood. About the year 1668 this pest was particularly prevalent and caused incalculable mischief, and in 1783 it is estimated that a million and a half of trees were destroyed by it in the Hartz forests alone. At this period

when arrived at their perfect state they migrated in swarms like bees into Suabia and Franconia. At length between 1784 and 1789 in consequence of a succession of cold moist seasons the numbers of this scourge were sensibly diminished, but they appeared again in 1790 and so late as 1796 there was great reason to fear for the few fir trees that were left."

Westwood states that occasionally the evil was so great that prayers were offered in the churches against its extension. While we hope that our spruce tree bark-borer may never prove to be such a pest as this Tomicus, we certainly think that he deserves some special attention.

(1.)

PLANTS MOUNTED.

Ranunculus acris *L.*
Caltha palustris *L.*
Vaccaria vulgaris *Host.*
Ptelea trifoliata *L.*
Prunus pumila *L.*
Aralia hispida *Mx.*
Cornus stolonifera *Mx.*
Sambucus pubens *Mx.*
Solidago cæsia *L.*
Erigeron strigosum *Muhl.*
Cannabis sativa *L.*
Quercus alba *L.*
Q. bicolor *Willd*
Q. montana *Willd.*
Q. prinoides *Willd.*
Q. coccinea *Wang.*
Q. tinctoria *Bart.*
Q. rubra *L.*
Carex bromoides *Schk.*
Agrostis alba *L.*

New to the Herbarium.

Aconitum Napellus *L.*
Solidago elliptica *Ait.*
Polygonum Careyi *Olney.*
P. Hartwrightii *Gr.*
Euphorbia Cyparissias *L.*
Scirpus Olneyi *Gr.*
Carex striata *Mx.*
Botrychium Lunaria *Sw.*
B. matricariæfolium *A.Br.*
Lycopodium sabinæfolium
Thelia Lescurii *Sulliv.*
Hypnum Oakesii *Sulliv.*
Hypnum exannulatum *Gumb.*
H. cupressiforme *L.*
H. acutum *Mitt.*
Sphagnœcetis Hubeneriana
Jungermannia albescens *Hook.*
J. ventricosa *Dicks.*
Scapania undulata *N. & M.*
Frullania Oakesiana *Aust.*
Cetraria Fahlunensis *Schœr.*
Lecanora badia *Fr.*
Cladonia deformis *Hoffm.*
C. papillaria *Hoffm.*

Bæomyces byssoides *Fr.*
Biatora milliaria *Fr.*
Lecidea arctica *Smf.*
L. Diapensiæ *Th. Fr.*
L. melancheima. *Tuck.*
Porphrydium cruentum *Ag.*
Agaricus cepæstipes *Sow.*
A. fumosoluteus *Pk.*
A. rosellus *Fr.*
A. constans *Pk.*
A. atroalboides *Pk.*
A. delectabilis *Pk.*
A. Acicula *Schæff.*
A. montanus *Pk.*
A. Rhododendri *Pk.*
A. infidus *Pk.*
A. fuscodiscus *Pk.*
A. luteofolius *Pk.*
A. chimonophilus *B. & Br.*
Coprinus aquatilis *Pk.*
Cortinarius fuscoviolaceus *Pk.*
Hygrophorus aurantiacoluteus
Gomphidius stillatus *Fr.*
Lactarius alpinus *Pk.*
Marasmius minutus *Pk.*
M. minutissimus *Pk.*
Panus operculatus *B. & C.*
Polyporus cupulæformis *B.&C*
P. squamosus *Fr.*
P. volvatus *Pk.*
P. vulgaris *Fr.*
P. incarnatus *Fr.*
Trametes odoratus *Fr.*
Merulius porinoides *Fr.*
Stereum balsameum *Pk.*
S. versiforme *B. & C.*
Corticium calceum *Fr.*
C. colliculosum *B. & C.*
C. cremoricolor *B. & C.*
C. lilacinofuscum *B. & C.*
Cyphella candida *Pk.*
Clavaria spathulata *Pk.*
Typhula gyrans *Fr.*
T. filicina *Pk.*
Tremella enata *B. & C.*
T. stipitata *Pk.*
Dacrymyces fragiformis *Nees.*
Ditiola radicata *Fr.*
Reticularia umbrina *Fr.*
Diderma umbilicatum *Pers.*
Phoma ellipticum *Pk.*
Septoria Verbenæ *D. & R.*
Discosia Maculæcola *Ger.*
Pestalozzia Mariæ *Clinton.*
Coryneum triseptatum *Pk.*
Spilocæa concentrica *Schw.*
Helicosporium olivaceum *Pk.*
H. ellipticum *Pk.*
Sporidesmium concinnum *B&C*
Puccinia Veratri *Clinton.*
Uromyces Lilii *Clinton.*
Ustilago Syntherismæ *Schw.*
U. Erythronii *Clinton.*
Uredo Smilacis *Schw.*
U. Empetri *DC.*
Æcidium dubium *Clinton.*
Peridermium elatinum *Lk.*
P. balsameum *Pk.*
P. decolorans *Pk.*
Pterula setosa *Pk.*
Cladosporum Lignicola *Cd.*
Oidium corticale *Pk.*
Fusidium flavovirens *Fr.*
Monilia candida *Pk.*
Pilobolus crystallinus *Tode.*
Chætomium melioloides *C.& P.*
Helvella sphærospora *Pk.*
Mitrula cucullata *Fr.*
M. inflata *Schw.*
Peziza adusta *C. & P.*
P. subcarnea *C. & P.*
Ascobolus pilosus *Fr.*

Helotium aciculare *Fr.*
H. fastidiosum *Pk.*
Tympanis Fraxini *Schw.*
Hysterium tumidum *Duby.*
H. xylomoides *Chev.*
H. Rhododendri *Schw.*
Rhytisma monogramma *B. & C.*
Torrubia entomorrhiza *Fr.*
Epichloe Hypoxylon *Pk.*
Hypomyces aurantius *Tul.*
Nectria episphæria *Fr.*
Dothidea tetraspora *Fr.*
Dothidea Dalibardæ *Pk.*
Diatrype platasca *Pk.*
D. corniculata *Ehrh.*
Valsa impulsa *C. & P.*
V. Peckii *Howe.*
Lophiostoma sexnucleata
Sphæria thujina *Pk.*
S. pilifera *Fr.*
S. lagenaria *Pers.*
S. orthogramma *B. & C.*
S. Parnassiæ *Pk.*
S. Arceuthobii *Pk.*

(2.)

PLANTS COLLECTED.

Pyrus sambucifolia *C. & S.*
Aster amethystinus *Nutt.*
Bromus tectorum *L.*
Glæocapsa rupestris *Kutz.*
Hydrogastrum granulatum *L.*
Spirogyra longata *Vauch.*
Agaricus pusillomyces *Pk.*
A. tenerrimus *Berk.*
A. Austini *Pk.*
A. Watsoni *Pk.*
A. detersibilis *Pk.*
A. Colvini *Pk.*
Coprinus Seymouri *Pk.*
Hygrophorus marginatus *Pk.*
H. parvulus *Pk.*
H. Peckianus *Howe.*
Cantharellus pruinosus *Pk.*
Lentinus umbilicatus *Pk.*
Boletus robustus *Frost.*
B. chromapes *Frost.*
Polyporus Stephensii *Berk.*
Hydnum aurantiacum *Batsch.*
Michenera Artocreas *B. & C.*
Corticium giganteum *Fr.*
Corticium colliculosum *B. & C.*
Cyphella muscigena *Fr.*
Solenia filicina *Pk.*
Clavaria rugosa *Bull.*
C. pulchra *Pk.*
C. gracillima *Pk.*
Typhula Grevillei *Fr.*
Tremella vesicaria *Bull.*
T. mycetophila *Pk.*
Æthalium geophilum *Pk.*
Licea ochracea *Pk.*
Diderma flavidum *Pk.*
Didymium oxalinum *Pk.*
D. subroseum *Pk.*
D. flavidum *Pk.*
Dictydium umbilicatum *Schrd.*
Phoma pallens *B. & C.*
Sphæropsis Sambuci *Pk.*
S. biformis *Pk.*
Hendersonia Sarmentorum
Vermicularia coptina *Pk.*
Septoria Scrophulariæ *Pk.*
S. Rhoidis *B. & C.*
Dinemasporium Pezizula *B. & C.*

Cytispora Micheneri *B. & C.*
Discella discoidea *C. & P.*
Sphæronema oxysporum *Berk*
S. conforme *Pk.*
Coryneum Kunzei *Cd.*
Pestalozzia insidens *Zab.*
Septonema bicolor *Pk.*
Sporidesmium Lepraria *B.&Br*
Melanconium disseminatum *Fr*
M. oblongum *B. & C.*
Puccinia Sorghi *Schw.*
Ustilago destruens *Duby.*
Peridermium columnare *A.&S.*
Æcidium Dracontiatum *Schw.*
Cystopus Amaranthi *Schw.*
Stilbum candidum *Pk.*
Stachybotrys lobulata *Berk.*
Haplographium apiculatum
Helminthosporium Urticæ *Pk.*
Macrosporium Saponariæ *Pk.*
Nematogonum aurantiacum
Perenospora Geranii *Pk.*
P. obliqua *Ck.*
Erysiphella aggregata *Pk.*
Microsphæra Van Bruntiana
Chætomium lanosum *Pk.*
Geoglossum velutipes *Pk.*
Peziza onotica *Pers.*
P. repanda *Wahl.*
P. pallidula *C. & P.*
P. omphalodes *Bull.*
P. sepulta *Fr.*
P. ovilla *Pk.*
P. clandestina *Bull.*
P. fusicarpa *Ger.*
P. hyalina *Pers.*
P. cinera *Batsch.*
P. scirpina *Pk.*
P. Pteridis *A. & S.*
P. corneola *C. & P.*
P. subatra *C. & P.*

Peziza atrocinerea *Ck.*
Helotium pileatum *Pk.*
H. salicellum *Fr.*
Patellaria fusispora *C. & P.*
P. fenestrata *C. & P.*
Dermatea cinnamomea *C. & P.*
Sphinctrina tigillaris *B. & Br.*
Cenangium Rubi *Fr.*
C. Aucupariæ *Fr.*
C. deformatum *Pk.*
Stictis pupula *Fr.*
S. hysterina *Fr.*
S. quercina *Pk.*
Rhytisma Urticæ *Fr.*
Hysterium Rousselii *De Not.*
H. clavisporum *C. & P.*
Colpoma lacteum *Pk.*
Ailographum subconfluens *Pk*
Torrubia clavulata *Schw.*
T. superficialis *Pk.*
Nectria sanguinea *Fr.*
Hypoxylon fuscopurpureum
Dothidea Linderæ *Ger.*
Diatrype aspera *Fr.*
D. discoidea *C. & P.*
D. anomala *Pk.*
Melanconis bicornis *Cooke.*
Valsa Prunastri *Fr.*
V. Rubi *Pk.*
V. Woolworthi *Pk.*
V. leiphemia *Fr.*
V. acerina *Pk.*
V. oxyspora *Pk.*
V. obscura *Pk.*
V. mucronata *Pk.*
V. femoralis *Pk.*
V. sambucina *Pk.*
Cucurbitaria alnea *Pk.*
C. seriata *Pk.*
Lophiostoma Jerdoni *B. & Br.*
L. macrostoma *Fr.*

Lophiostoma triseptata *Pk.*
L. Spiraeæ *Pk.*
L. Scrophulariæ *Pk.*
Sphæria callista *B. & C.*
S. subcorticalis *Pk.*
S. hirtissima *Pk.*
S. phæostromoides *Pk.*
S. eximia *Pk.*
S. canina *Pk.*
S. valsoides *Pk.*
S. minima *Awd.*
S. scoriadea *Fr.*
S. monosperma *Pk.*
Sphæria pulicaris *Pers.*
S. rubefaciens *Pk.*
S. Urticæ *Rabh.*
S. mirabilis *Pk.*
S. tubæformis *Tode.*
Sphærella sparsa *Awd.*
S. carpinea *Fr.*
S. indistincta *Pk.*
S. orbicularis *Pk.*
Venturia Myrtilli *Cooke.*
V. maculans *Pk.*
V. Clintonii *Pk.*
V. Kalmiæ *Pk.*

(3.)

CONTRIBUTORS AND THEIR CONTRIBUTIONS.

Miss M. L. WILSON, Buffalo, N. Y.

Collema limosum *Nyl.*
Biatora uliginosa *Fr.*

Mrs. L. A. MILLINGTON, Glens Falls, N. Y.

Aspidium Noveb. *v.* fragrans.
Dothidea Pteridis *Fr.*
Peridermium decolorans *Pk.*
P. elatinum *A. & S.*

Mrs. E. E. ATWATER, Chicago, Ill.

Sarracenia variolaris *Mx.*
Viola ped. *v.* bicolor.
Drosera capillaris *Poir.*
D. brevifolia *Ph.*
Ascyrum amplexicaule *Mx.*
Silene Pennsylvanica *Mx.*
Melia Azederach *L.*
Sassafras officinale *Nees.*
Lycopodium alopecuroides *L.*
Dicranum scoparium *L.*
Leucobryum minus *Hampe.*
Hedwigia ciliata *Ehrh.*
Bryum Atwateriæ *C. Mull.*
Hypnum molluscum *Hedw*
Lentinus Lecomtei *Fr.*
Polyporus hirsutus *Fr.*
P. cinnabarinus *Fr.*
Stereum fasciatum *Fr.*
Mitremyces lutescens *Schw.*
Peridermium Cerebrum *Pk.*

Rev. H. WIBBE, Oswego, N. Y.

Sedum reflexum *L.*

Rev. J. L. ZABRISKIE, New Baltimore, N. Y.

Dinemasporium Pezizula *B.&C*
Pestalozzia insidens *Zab.*
P. rostrata *Zab.*
Blastesis tridens *Zab.*
Lophiostoma Jerdoni *B. & Br.*
Diatrype discoidea *C. & P.*

Prof. C. E. BESSEY, Ames, Iowa.

Ustilago fœtens *B. & C.*
Ustilago destruens *Duby.*

Prof. A. N. PRENTISS, Ithaca, N. Y.

Negundo aceroides *Mœnch.*
Nardosmia palmata *Hook.*
Pinguicula vulgaris *L.*
Primula Mistassinica *Mx.*
Trillium erec. *v.* album *Ph.*

Prof. J. HALL, Albany, N. Y.

Hellvella esc. *v.* conica *Fr.*
Spilocæa Pomi *Fr.*

C. DEVOL, M. D., Albany, N. Y.

Platycerium alcicorne *Gaud.*
Cucurbitaria seriata *Pk.*

E. C. HOWE, M. D., Yonkers, N. Y.

Centaurea nigra *L.*
Coryneum dis. *v.* ellipticum.
Puccinia bullaria *Lk.*
Patellaria dispersa *Ger.*
Diatrype prominens *Howe.*
Microsphæra Platani *Howe.*
M. Symphoricarpi *Howe.*
M. Menispermi *Howe.*
M. Viburni *Schw.*
Sphæria Platanicola *Howe.*

H. WILLEY, New Bedford, Mass.

Synalissa Schæreri *Mass.*
Ramalina rigida *Pers.*

R. KERSTING, Yonkers, N. Y.

Centaurea nigra *L.*

H. A. WARNE, Oneida, N. Y.

Azolla Caroliniana *Willd.*
Hydnum auriscalpium *L.*
Epichloe typhina *Berk.*
Geoglossum velutipes *Pk.*

E. L. HANKENSON, Newark, N. Y.

Habenaria leucophæa *Nutt.*

W. R. GERARD, Poughkeepsie, N. Y.

Septoria maculosa *Ger.*
Stilbum aurifilum *Ger.*
Peziza Cucurbitæ *Ger.*
Patellaria dispersa *Ger.*
Hysterium vixvisibile *Ger.*
H. magnosporium *Ger.*

J. T. LOCKWOOD, Hunter, N. Y.

Lygodium palmatum *Sw.*

B. D GILBERT, Utica, N. Y.

Carex Grayi *Carey.*
C. Crawei *Dewey.*
C. livida *Willd.*
Brotychium matricariæfolium *A. Br.*

M. RUGER, New York, N. Y.

Amarantus spinosus *L.*
Scleria verticillata *Mx.*

E. S. MILLER, Wading River, N. Y.

Ustilago Montagnei *v.* major *Desm.*

J. B. ELLIS, Newfield, N. J.

Agaricus trullisatus *Ellis.*
Polyporis contiguus *Fr.*
Thelephora pedicellata *Schw.*
Hymenochæte tabacina *Fr.*
H. agglutinans *Ellis.*
Corticium colliculosum *B. &C.*
Exobasidium discoideum *Ellis*
E. Andromedæ *Pk.*
Scleroderma Geaster *Fr.*
Hendersonia sarmentorum.
Pestalozzia pezizoides *DeNot.*
Melanconium magnum *Berk.*
M. bicolor *Nees.*
Bactridium Ellisii *Berk.*
Septonema bicolor *Pk.*
Phragmidium mucronatum *Fr*
P. speciosum *Fr.*
Puccinia Smilacis *Schw.*
P. Helianthi *Schw.*
Uromyces Spermacocis *Schw.*
Ustilago Syntherismæ *Schw.*
Rœstelia Ellisii *Pk.*
Æcidium pyratum *Schw.*
Æ. myricatum *Schw.*
Peridermium pyriforme *Pk.*
Gymnosporangium Juniperi.
G. clavipes *C. & P.*
G. biseptatum *Ellis.*
Podisoma Ellisii *Berk.*
Dendriphium quadriseptatum.
Helminthosporium 7-septatum.
Chætomium melioloides *C.&P.*
Peziza albopileata *Ck.*
P. Erigeronata *Ck.*
P. pollinaria *Ck.*
P. protrusa *B. & C.*
P. Andropogonis *B. & C.*
Nectria inaurata *B. & Br.*
Triblidium unisculptum *Ck.*
Hypoxylon Sassafras *Schw.*
H. marginatum *Schw.*
Valsa Peckii *Howe.*
Sphæria hirtissima *Pk.*
S. pulveracea *Ehrh.*
Venturia pulchella *C. & P.*

Hon. T. M. PETERS, Moulton, Ala.

Neviusia Alabamensis *Gr.*
Leavenworthia Michauxii *Tor.*
Diamorpha pusilla *Nutt.*
Asplenium pinnatifidum *Nutt*
Trichomanes radicans *Sw.*
T. Petersii *Gr.*
Lemanea fluviatilis *Ag.*
Myriangium Curtisii *M. & B.*
Corticium prasinum *B. & C.*
Hygrophorus Petersii *B. & C.*
Pilacre Petersii *B. & C.*
Hypocrea Petersii *B. & C.*
Hypoxylon Petersii *B. & C.*
Dendrina Diospyri *B. & C.*

Hon. G. W. CLINTON, Buffalo, N. Y.

Stereum candidum *Schw.*
Phoma Mariæ *Clinton.*
Sphæropsis Wilsoni *Clinton.*
S. Squieriæ *Clinton.*
S. Clintonii *Pk.*
Diplodia Herbarum *Lev.*
Hendersonia Peckii *Clinton.*
H. Mariæ *Clinton.*
Septoria Scrophulariæ *Pk.*
S. Rhoidis *B. & C.*
S. Verbascicola *B. & C.*
S. Sambucina *Pk.*
S. Wilsoni *Clinton.*
Vermicularia coptina *Pk.*
Asteroma Rosæ *DC.*
Cytispora Micheneri *B. & C.*
Melanconium minutissimum.
Pestalozzia Peckii *Clinton.*
Puccinia Smilacis *Schw.*
P. Dayi *Clinton.*
P. Clintonii *Pk.*
P. Sorghi *Schw.*
Uromyces Graminum *Ck.*
Protomyces Menyanthis.
Monotospora biseptata *Pk.*
Microsphæra abbreviata *Pk.*
Helotium salicellum *Fr.*
Sphinctrina tigillaris *B. & Br.*
Hysterium clavisporum *C.&P.*
Melogramma Bulliardi *Tul.*
Melanconis bicornis *Ck.*
Valsa suffusa *Fr.*
V. femoralis *Pk.*
Lophiostoma triseptata *Pk.*
Sphæria callista *B. & C.*
S. acer. *v.* Juniperi *West.*
S. rubefaciens *Pk.*
S. Daturæ *Schw.*
S. perisporioides *B. & C.*
Sphærella oblivia *Ck.*
S. carpinea *Fr.*
S. sparsa *Awd.*
Venturia Clintonii *Pk.*

C. F. AUSTIN, Closter, N. J.

Barbula recurvifolia *Schp.*
Hypnum compactum *C. Mull.*
Tremella foliacea *Pers.*
Pistillaria Muscicola *Fr.*
Perichæna flavida *Pk.*
Licea perreptans *Berk.*
Morchella esculenta *Pers.*
Leotia lubrica *Pers.*
Torrubia militaris *Fr.*
Xylaria polymorpha *Grev.*
Sphæria fimbriata *Pers.*
S. coprophila *Fr.*

C. C. PARRY, Davenport, Iowa.

Æcidium biforme *Pk.*	Calyptospora Gœppertiana *Kühn.*

J. M. CONGDON, East Greenwich, R. I.

[*By exchange.*]

Acer macrophyllum *Ph.*	Eleocharis rostellata *Torr.*
Desmodium sessilifolium *T.&G*	Rhynchospora scirpoides *Gr.*
Hedysarum boreale *Nutt.*	Scirpus sylvaticus *L.*
Garrya Fremontii *Don.*	Scleria reticularis *Mx.*
Plectritis congesta *DC.*	Carex salina *Wahl.*
Galium verum *L.*	C. maritima *Vahl.*
Aster graminifolius *Ph.*	C. polymorpha *Muhl.*
Solidago elliptica *Ait.*	C. muricata *L.*
Primula suffruticosa *Gr.*	C. paludosa *Good.*
Sarcodes sanguinea *Don.*	C. præcox *Jacq.*
Mimulus rubellus *Gr.*	C. Novæ-Angliæ *Schw.*
Gilia pungens *Gr.*	Calamagrostis stricta *Trin.*
Castanea chrysophylla *Doug.*	C. Lapponica *Trin.*
Lacnanthes tinctoria *Ell.*	Oryzopsis Canadensis *Don.*
Listera convallarioides *Hook.*	Poa cæsia *Sm.*

(4.)

PLANTS, INDIGENOUS AND INTRODUCED, NOT BEFORE REPORTED.

NEGUNDO ACEROIDES *Mœnch.*

Inlet Valley, near Ithaca. *Prof. A. N. Prentiss.* The credit of the discovery of these trees in the locality given is attributed to *Mr. J. C. Branner*, a student of Cornell University.

PYRUS SAMBUCIFOLIA *Cham. & Schl.*

Adirondack Mountains. Not common.

SEDUM REFLEXUM *L.*

Near Burden's lake, Rensselaer county. *Rev. H. Wibbe.* I am informed by Mr. Wibbe that the plants grow on a bank by the road-side, in a reddish soil of clay and shale and that they appear to be thoroughly naturalized. He was unable to learn upon inquiry that the plant is now or ever had been in cultivation any where in the vicinity.

ASTER AMETHYSTINUS *Nutt.*

Green Island, Albany county. The locality of this fine aster was made known to me by *Mr. Wibbe.* The plants are not numerous and are associated with *Aster Novæ-Angliæ* and *A. multiflorus.*

CENTAUREA NIGRA *L.*

Rocky places. Yonkers. *R. Kersting* and *E. C. Howe.*

HABENARIA LEUCOPHÆA *Nutt.*

Sphagnous marshes on the shores of Mud pond, Wayne county. *E. L. Hankenson.*

BROMUS TECTORUM *L.*

Riverhead, Long Island. *E. S. Miller.*

BARBULA RECURVIFOLIA *Schp.*

Watkins Glen. *C. F. Austin.* Sterile.

HYPNUM COMPACTUM *C. Mull.*

Eldridge Glen, near Seneca lake, *Austin.* Sterile.

BIATORA ULIGINOSA *Schrad.*

North Collins. *Miss. M. L. Wilson.*

SYNALISSA SCHÆRERI *Mass.*

Rocks. Trenton Falls. *H. Willey.*

COLLEMA LIMOSUM *Ach.*

Buffalo. Very rare. *Miss Wilson.*

GLÆOCAPSA RUPESTRIS *Kutz.*

What I take to be this species is not rare about Albany, forming a green stratum on stone steps, walls of buildings, old fences and trunks of trees. It is most conspicuous in wet weather in winter and spring. I have not seen a full description of the species.

HYDROGASTRUM GRANULATUM *L.*

Damp ground in dried water holes. North Greenbush. This plant has been supposed by some to be the cause of ague and has therefore been called the "ague plant," but it is hardly probable that it has any such deleterious quality.

SPIROGYRA LONGATA *Vauch.*

In ditches along the railroad. North Greenbush. June.

AGARICUS (LEPIOTA) PUSILLOMYCES *n. sp.*

Pileus thin, subcampanulate or convex, subumbonate, minutely granular-mealy, whitish or dingy; lamellæ broad, close, free, white; stem slender, equal, exannulate, rough with a granular-mealiness, colored like the pileus; spores elliptical, .00016′–.0002′* long.

Plant scarcely 1′ high, pileus 2″–4″ broad, stem .5″ thick.

Ground under *Pteris aquilina*. Lake Pleasant. August. (Plate 1, figs. 1–8.)

The species is related to *A. granulosus* but the plants are very much smaller and ringless.

AGARICUS TENERRIMUS *Berk.*

Under pine and hemlock trees. Northville, Fulton county. August.

AGARICUS (OMPHALIA) AUSTINI *n. sp.*

White, rather tenacious; pileus convex or hemispherical, glabrous, striate, deeply umbilicate, sometimes perforate, viscid when moist; lamellæ subdistant, decurrent; stem slender, equal, hollow, smooth, villose at the base; spores elliptical, .00025′ long.

Plant gregarious, about 1′ high, pileus 3″–6″ broad.

Prostrate dead trunk of a small spruce tree. Providence, Saratoga county. August.

Dedicated to *Mr. C. F. Austin.*

AGARICUS (ECCILIA) WATSONI *n. sp.*

Pileus hemispherical or convex, umbilicate, striatulate, brown, the umbilicus darker and rough with minute blackish-brown scales; lamellæ distant, arcuate, decurrent, whitish then flesh-colored; stem equal, smooth, shining, brownish or pallid; spores angular, generally with a single nucleus, .00035′–.0004′ in diameter.

Plant 1′ high, pileus 5″–10″ broad, stem .5″–1″ thick.

Ground in woods. Northampton, Fulton county. August.

Dedicated to *Mr. Sereno Watson.*

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* One accent (,) denotes inch or inches, two accents (,,) denote line or lines.

AGARICUS (PHOLIOTA) DETERSIBILIS *n. sp.*

Pileus hemispherical or convex, thin, densely coated with small erect pyramidal or spinulose scales, ochraceous-brown; lamellæ broad, plane, close, reaching the stem, slightly attached, pallid then cinnamon-brown; stem equal, stuffed or hollow, squamulose below the obsolete ring, colored like the pileus, often curved; spores unequally elliptical, .0003′–.00035′ long.

Plant about 1′ high, pileus 6″ broad, stem 1″ thick.

Decaying trunks of deciduous trees in woods. Lake Pleasant. August.

The small soft scales are rubbed off easily, whence the specific name. I suspect that under more favorable conditions the plant may grow considerably larger than the dimensions given.

AGARICUS (HEBELOMA) COLVINI *n. sp.*

Pileus fleshy, convex or expanded, sometimes gibbous or broadly umbonate, rarely centrally depressed, glabrous grayish or alutaceous inclining to pale ochre; lamellæ close, broad, emarginate or rounded behind, whitish or pallid becoming brownish; stem flexuous, silky-fibrillose, stuffed or hollow, solid toward the base, whitish; spores subelliptical, .0004′-.0005′ long.

Plant 2′–4′ high, pileus 1′–3′ broad, stem 1″–3″ thick.

Sand hills near West Albany. October.

This interesting species is dedicated to *Mr. V. Colvin*, to whom is due the credit of its discovery. Its habitat is peculiar, being the clear drifting sand of the plains west of Albany. The mycelium binds the sand together in a mass which adheres to the base of the stem. A cricket was observed feeding upon the pileus of a small specimen.

COPRINUS SEYMOURI *n. sp.*

Cæspitose, fragile; pileus thin, soon expanded, smooth or sprinkled with minute granular scales, dark-brown, the disk sometimes with a reddish tinge, strongly striate or subplicate, the thin margin soon splitting and revolute; lamellæ close, narrow, reaching the stem, brown then black; stem equal, hollow, smooth or slightly pulverulent, white; spores broadly ovate, compressed, .00025′-.0003′ long, .0002′–00025′ broad.

Plant 3′–4′ high, pileus 8″–12″ broad, stem 1″ thick.

Clay soil. Albany. October.

It is allied to *C. micaceus*, but is thinner, more fragile, darker in color, with more narrow lamellæ which are darker in the young plant. The species is respectfully dedicated to *Hon. H. Seymour.*

HYGROPHORUS MARGINATUS *n. sp.*

Fragile; pileus subcampanulate or expanded, often irregular or lobed, sometimes broadly umbonate, glabrous, shining, often minutely rimose, striatulate on the thin margin, bright golden-yellow; lamellæ rather broad, subdistant, ventricose, emarginate, often venose-connected, yellow, becoming more highly colored with age, the edge generally changing to orange or vermilion; stem smooth, hollow, often flexuous or irregular, pale yellow; spores subelliptical, about .0003′ long.

Plant 2′ high, pileus about 1′ broad, stem 1″–2″ thick.

Ground in woods. Northville. August.

This seems to be the American analogue of the European *H. obrusseus.* After considerable hesitation I have ventured to separate it as a species because of its smaller size and the red color of the edge of the lamellæ, a singular character which has suggested the specific name.

HYGROPHORUS PARVULUS *n. sp.*

Pileus thin, hemispherical or convex, smooth, hygrophanous, striatulate on the margin when moist, sulphur-yellow; lamellæ, subdistant, arcuate, adnate or decurrent, pale-yellow or whitish; stem equal, smooth, hollow, pale-yellow or luteous.

Plant 1′ high, pileus 3″–4″ broad.

Ground in woods and under *Pteris aquilina.* Northville and Lake Pleasant. August. (Plate 1, figs. 20–24.)

The stem and pileus are slightly viscid when young and moist. The stem is sometimes more highly colored than the pileus, an unusual feature in the Agaricini.

HYGROPHORUS PECKIANUS *Howe.*

Ground under *Pteris aquilina.* Lake Pleasant. August.

LACTARIUS AQUIFLUUS *n. sp.*

Pileus fragile, fleshy, convex or expanded, at length centrally depressed, dry, smooth, or sometimes appearing as if clothed with a minute appressed tomentum, reddish tan-

colored, the decurved margin often flexuous; lamellæ rather narrow, close, whitish, becoming dull reddish yellow; stem more or less elongated, equal or slightly tapering upward, colored like the pileus, smooth, hollow, the cavity irregular as if eroded; spores subglobose, rough, .0003′ in diameter; flesh colored like the pileus; milk sparse, watery.

Plant 3′–8′ high, pileus 3′–6′ broad, stem 5″–10″ thick.

Swamps and wet mossy places in woods. Sandlake and North Elba. August and September.

The relationship of this plant is with *L. serifluus*, to which it was formerly referred, but from which I am now satisfied it is distinct. The hollow stem is a constant character in our plant, and affords a ready mark of distinction. The plant, though large, is very fragile, and breaks easily. The taste is mild or but slightly acrid. Sometimes there is an obscure zonation on the pileus, which, in large specimens, is apt to be irregular and much worm-eaten. The milk looks like little drops of water when first issuing from a wound, but it becomes a little less clear on exposure to the atmosphere. The decided but agreeable odor of the dried specimens persists a long time.

CANTHARELLUS PRUINOSUS *n. sp.*

Pileus convex, even or slightly umbilicate, pruinose, white; lamellæ distant, simple, long-decurrent; stem slender, slightly enlarged above, pruinose, whitish.

Plant scarcely 1′ high, pileus 2″–3″ broad.

Ground in pastures. Sageville, Hamilton county. August.

The small size and white mealy pruinosity are distinguishing features in this species. But for the obtuse edge of the lamellæ it might readily be taken for some small Omphalia, especially as the lamellæ are not branched.

LENTINUS UMBILICATUS *n. sp.*

Pileus fleshy, thin, tough, smooth, deeply umbilicate hygrophanous, brownish tan-colored when moist, paler when dry; lamellæ crowded, adnate or decurrent, serrate on the edge, whitish; stem slender, short, smooth, nearly even, tough, stuffed or hollow, central or eccentric, colored like the pileus.

Plant about 1′ high, pileus 6″–12″ broad, stem 1″ thick.

Ground and old logs. Lake Pleasant. August. (Plate 1, figs. 15–19.)

It is related to *L. cochleatus*, which it resembles in color

and texture, but it is a much smaller plant, with a more slender and not sulcate stem. It is gregarious in habit. The form with eccentric stem grew on decaying logs, and has the stem more or less curved.

BOLETUS ROBUSTUS *Frost.*
Borders of woods. Sandy Creek, Oswego county. July.

BOLETUS CHROMAPES *Frost.*
Woods. Northville. August.

POLYPORUS STEPHENSII *Berk.*
Under side of spruce logs in woods. Indian Lake. July. It forms patches several feet in extent.

HYDNUM AURANTIACUM *Batsch.*
Ground. Albany. August.

HYDNUM AURISCALPIUM *L.*
Old cones of Scotch fir. Oneida. *H. A. Warne.* Autumn.

MICHENERA ARTOCREAS *B. & C.*
Dead branches of black ash, *Fraxinus sambucifolia.* Lake Pleasant. August.

The hymenium in our specimens is of a dull reddish or pale chestnut color, and the spores are generally bluntly pointed or beaked, but the species is so singular that I have no doubt of the correctness of the determination.

CORTICIUM GIGANTEUM *Fr.*
Pine wood and bark. Albany.

CORTICIUM COLLICULOSUM *B. & C.*
Dead branches. North Greenbush.

STEREUM CANDIDUM *Schw.*
Bark of trees. Gowanda, Erie county. *G. W. Clinton.*

CYPHELLA MUSCIGENA *Fr.*
Mosses on precipices in woods. Lake Pleasant. August.

SOLENIA FILICINA *n. sp.*
Cups springing from an ochraceous, white-margined, tomentose subiculum, elongated, clavate or cylindrical, deflexed, clothed with appressed hairs or tomentum, ochra-

ceous; spores hyaline, broadly fusiform, pointed at the ends, containing one or two nuclei, .0004′ long.

Base of living fern stems. Lake Pleasant. August.
The basal part of the cups sometimes turns brown and shrinks in size, so that they appear as if stipitate. Both the habitat and the effused stratum of tomentum are noteworthy features.

CLAVARIA RUGOSA *Bull.*

Ground in woods. Northampton and Sageville. August,

CLAVARIA PULCHRA *n. sp.*

Simple, small, about 1′ high, club elongate-clavate, obtuse, yellow, sometimes a little darker at the apex, gradually tapering into the whitish or pale yellow stem-like base.

Ground and decaying wood in damp shaded places. Northville and Chittenango Falls. August. (Plate 1. fig. 10.)
A pretty species, associated with *C. fusiformis* in both localities, but differing from it in shape and habit.

CLAVARIA GRACILLIMA *n. sp.*

Simple, very slender, smooth, about 1′ high, rather tough; club acute or acuminate, pale yellow, a little thicker than the long slender distinct bright yellow shining stem.

Among moss in a pasture. Northville. August. (Plate 1, fig. 9.)
In this species, as in *C. argillacea*, the hymenium is quite distinct from the stem.

TYPHULA GREVILLEI *Fr.*

Fallen leaves. Lake Pleasant. August.
The stem in our specimens is not distinctly pilose.

TREMELLA VESICARIA *Bull.*

Ground in damp shaded places. Oneida. *Warne.* Albany and Greenbush.

TREMELLA MYCETOPHILA *n. sp.*

Suborbicular, depressed, gyrose-plicate, tremelloid-fleshy, slightly pruinose, yellowish or pallid, 4″–8″ broad.

Stem and pileus of *Agaricus dryophilus*. Oneida. *Warne.* North Elba. August. (Plate 1, fig. 4.)

ÆTHALIUM GEOPHILUM *n. sp.*

Effused in small irregular masses, whitish or yellowish, sometimes with a slight pinkish tinge; spores globose, colorless, .00016′–.0002′ in diameter.

Damp ground in woods. Sageville. August.
The small size and colorless spores furnish the distinguishing characters of this species.

DIDERMA FLAVIDUM *n. sp.*

Cæspitose, small, external peridium thick, pale yellow or lemon color outwardly, white within, rupturing irregularly, inner peridium delicate; flocci white; spores black, globose, minutely rough, .0005′ in diameter.

Among moss on decaying wood. Lake Pleasant. August.

DIDYMIUM OXALINUM *n. sp.*

Small, sessile, scattered or crowded, subglobose or elongated and somewhat confluent, plumbeus; peridium thin, clothed with a minute whitish mealiness, whitish when evacuated, tawny or reddish-brown within at the base; columella white, subglobose; flocci slender, colored; spores globose, blackish-brown, with a purplish tinge, .00033′–.00035′ in diameter.

Living leaves and petioles of wood sorrel, *Oxalis Acetosella.* Williamstown, Oswego county. July.

DIDYMIUM SUBROSEUM *n. sp.*

Peridium subglobose, externally farinaceous, pinkish-white; stem short, white, equal or slightly tapering upward; flocci white; spores globose, smooth, purplish-black, 00033′ in diameter.

Bark of butternut trees, *Juglans cinerea.* Williamstown. July

DIDYMIUM FLAVIDUM *n. sp.*

Peridium subglobose, sessile, thin, yellow, clothed with a minute yellow mealiness; spores subglobose, black, .0004′ in diameter.

Bark of dead balsam trees, *Abies balsamea.* North Elba August.

DICTYDIUM UMBILICATUM *Schrad.*

Decaying wood. North Greenbush. June.

LICEA OCHRACEA *n. sp.*

Peridia short, connate, springing from a white gelatinous hypothallus, coated externally with a minute golden-yellow or bright-ochraceous mealiness; spores globose, purplish black, .0004′ in diameter.

Living grass and club moss, *Lycopodium annotinum*. Lake Pleasant. August.

The tufts or patches are small and when moist are of a brown color, but upon drying the yellow color of the minute branny scales or mealiness becomes apparent.

PHOMA PALLENS *B. & C.*

Dead stems of woodbine, *Ampelopsis quinquefolia*. North Greenbush. June.

PHOMA MARIÆ *Clinton n. sp.*

Perithecia minute, punctiform or subhysteriform, covered by the epidermis, black; spores oblong-elliptical somewhat pointed, hyaline, with a nucleus near each end, .00033′ long.

Living stems of *Lonicera flava* and *L. Tartarica*. Buffalo. *Clinton*. November and January.

Dedicated to *Miss Mary L. Wilson*.

SPHÆROPSIS WILSONI *Clinton n. sp.*

Perithecia minute, punctiform, slightly prominent, covered by the epidermis which at length ruptures longitudinally, black; spores oblong-elliptical, colored, .0008′–.0009′ long.

Living stems of *Lonicera flava*. Buffalo. *Clinton*. January.

SPHÆROPSIS CLINTONII *n. sp.*

Perithecia minute, scattered, innate, black; spores elliptical or oblong-elliptical, colored .0005′–.0007′ long.

Decorticated maple wood. Buffalo. *Clinton*. January.

SPHÆROPSIS SQUIERIÆ. *Clinton n. sp.*

Perithecia small, numerous, covered by the epidermis which ruptures longitudinally, black; spores subglobose, colored, .0007′–.0008′ long.

Dead stems of *Aristolochia tomentosa*. Buffalo. *Clinton*. January.

SPHÆROPSIS SAMBUCI *n. sp.*

Perithecia subglobose, scattered or subcæspitose, rather prominent, erumpent, surrounded by the ruptured epidermis, black; spores oblong, colored, .0006′–.0008′ long.

Dead branches of elder, *Sambucus Canadensis.* North Greenbush, November.

Sphaeropsis mutica and *S. macropsora* are said to inhabit the elder, but the former is described as having very small hyaline spores, and the latter as having much larger subfusiform spores.

SPHÆROPSIS BIFORMIS *n. sp.*

Perithecia scattered, erumpent, some minute, rupturing the epidermis slightly, others larger, rupturing the epidermis distinctly, and generally longitudinally; spores variable, obovate elliptical or oblong, sometimes curved, colored, .0006′–.001′ long.

Dead branches of ash, *Fraxinus Americana.* Albany. May.

SPHÆRONEMA OXYSPORUM *Berk.*

Old *Merulius tremellosus.* Forestburgh. September.

SPHÆRONEMA CONFORME *n. sp.*

Perithecia scattered, erumpent, with a long, rigid, spine-like black ostiolum; globule whitish; spores subfusiform, generally curved, often with one or two nuclei, .0006′–.0008′ long.

Dead branches of apple trees. Center. June.

Almost exactly like *S. Spina* and *S. Magnoliæ* externally, but the spores afford distinguishing characters.

DIPLODIA HERBARUM *Lev.*

Dead stems of *Thalictrum cornuti.* Buffalo. *Clinton.*

HENDERSONIA SARMENTORUM *West.*

Dead bark of grape vines. North Greenbush. June.

HENDERSONIA PECKII *Clinton n. sp.*

Perithecia minute, punctiform, covered by the epidermis which is at length ruptured, black; sporophores long, slen-

der; spores oblong, slightly colored, triseptate, shorter than the sporophores, from which they soon separate, .0005′–.0007′ long.

Living stems of *Lonicera flava*. Buffalo. *Clinton*. January.

HENDERSONIA MARIÆ *Clinton n. sp.*

Perithecia as in the preceding species; sporophores shorter than the spores, persistent; spores oblong, often a little curved, five-septate, colored, with the basal cell and sometimes also the apical cell hyaline, about .001′ long.

Living stems of *Lonicera flava*. Buffalo. *Clinton*. January.

SEPTORIA SCROPHULARIÆ *n. sp.*

Spots small, arid, whitish, surrounded by a purplish-rown border; perithecia few, on the upper surface; spores filiform, curved, hyaline, .001′–.0016′ long.

Living leaves of *Scrophularia nodosa*. Buffalo. *Clinton*. Albany. June.

SEPTORIA RHOIDIS *B. & C.*

Leaves of sumach. Forestburgh. September. Buffalo. *Clinton*. October.

SEPTORIA VERBASCICOLA *B. & C.*

Leaves of *Verbascum Blattaria*. Buffalo. *Clinton*. August. The specimens agree with those distributed under this name by the late Dr. Curtis, but so far as I am aware no description has ever been published.

SEPTORIA MACULOSA *Ger.*

Leaves of *Cuphæa viscosissima*. Poughkeepsie. *W. R. Gerard*.

SEPTORIA WILSONI *Clinton n. sp.*

Spots scattered, suborbicular, arid, whitish or pallid, surrounded by a darker border; perithecia minute, blackish; spores filiform, more or less curved, sometimes nucleate, .0015′–.002′ long.

Leaves of *Chelone glabra*. Buffalo. *Clinton*.

SEPTORIA SAMBUCINA *n. sp.*

Spots arid, whitish, surrounded by a broad, dark margin, brown or purplish-brown on the lower surface; perithecia on the upper surface, few, minute; spores long, filiform, more or less curved, obscurely three to six-septate, .002′–.003′ long.

Leaves of elder, *Sambucus Canadensis*. Buffalo. *Clinton*. October.

VERMICULARIA COPTINA *n. sp.*

Perithecia minute, slightly prominent, black, with a tuft of divergent one or two-septate hairs at the apex; spores curved, pointed at each end, hyaline, .0008′–.001′ long.

Dead or dying leaves of gold thread, *Coptis trifolia*. Buffalo. *Clinton*. Sandlake and Sandy Creek. June to October.

DINEMASPORIUM PEZIZULA *B. & C.*

Decaying elder wood. New Baltimore. *Rev. J. L. Zabriskie*. North Greenbush. May and June.

BLASTESIS TRIDENS *Zab.*

Living quince leaves. Flatbush, Long Island. *Zabriskie*.

ASTEROMA ROSÆ *DC.*

Leaves of *Rosa rubiginosa*. Buffalo. *Clinton*. October.

CYTISPORA MICHENERI *B. & C.*

Dead ash branches. Angola. *Clinton*. Greenbush. May. It sometimes renders the branch rough for several feet.

DISCELLA DISCOIDEA *C. & P.*

Erumpent, discoid, reddish when moist, black or blackish when dry, surrounded by the lacerated epidermis which splits in a somewhat stellate manner; perithecia obsolete above; sporophores long, branched or simple, the branches subclavate; spores abundant, oblong or elliptical, colorless, .0008′–.0012′ long, containing a granular endochrome.

Dead branches of the water beech, *Carpinus Americana*. Greenbush. May. (Plate 1, figs. 34–37.)

MELANCONIUM DISSEMINATUM *Fr.*

Decaying wood. Richmondville and Hunter. June and July.

The masses of spores often occupy the summit of little protuberances of the wood, as if the fungus prevented or retarded the decay and wasting away of the woody tissues immediately beneath it.

MELANCONIUM OBLONGUM *B. & C.*

Bark of butternut trees, *Juglans cinerea.* Greenbush. May.

MELANCONIUM MINUTISSIMUM *Schw.*

Bark of *Platanus occidentalis.* Buffalo. *Clinton.* April.

CORYNEUM DISCIFORME *var.* ELLIPTICUM *B. & Br.*

Dead birch branches. Yonkers. *Howe.*

CORYNEUM KUNZEI *Cd.*

Dead branches of white birch, *Betula populifolia.* West Albany. May.

PESTALOZZIA INSIDENS *Zab.*

Bark of Elm trees. New Baltimore. *Zabriskie.* Hunter, Greene county. April and June.

The spores in this species are .0011′–.0015′ in length, exclusive of the long bristles at the extremities. There are generally four central colored cells.

PESTALOZZIA ROSTRATA *Zab.*

Bark of Lonicera and of apple trees. New Baltimore. *Zabriskie.*

Externally this species closely resembles the preceding, but the spores are smaller, being .001′ long, and have no bristle at the base. There are usually four central colored cells. I cannot distinguish the spores of this from those of *P. concentrica B. & R.*, from which, therefore, it differs only in habit and habitat, and to which it ought perhaps to be united.

PESTALOZZIA PECKII *Clinton n. sp.*

Pustules thickly scattered over the surface of the leaf or over indefinite grayish spots, erumpent, black; spores

straight or slightly curved, subfusiform, pale, with two or three colored central cells and a hyaline cell at each extremity, .0006′–.0007′ long exclusive of the single short sometimes deciduous apical bristle; pedicels slender, hyaline, about as long as the colored part of the spore.

Under surface of fallen oak leaves, *Quercus alba*. Buffalo. *Clinton*. May.

The apical hyaline cell is somewhat elongated and abruptly contracted into the short straight erect bristle. The species is allied to *P. hysteriiformis*, from which it differs in its much paler spores, more numerous orbicular pustules and absence of spots or in having its indefinite spots not at all concentrically divided.

SEPTONEMA BICOLOR *n. sp.*

Sori small, scattered, varying in color from yellowish to blackish, generally dark olivaceous with a paler or yellowish center; spores elliptical-oblong, somewhat irregular; multicellular, at length rough and opaque.

Decorticated surface of wood. Forestburgh. September.

The species is similar in habit to *S. spilomeum*, but the threads of spores are coarser, the sori are different in color and the spores are both transversely and vertically septate, making them multicellular, although this is seen with difficulty except in the younger spores.

SPORIDESMIUM LEPRARIA *Berk.*

Decaying wood. Sandlake, Rensselaer county.

PUCCINIA BULLARIA *Lk.*

Stems of Sanicula. New Baltimore. *Howe.*

PUCCINIA SMILACIS *Schw.*

Leaves of *Smilax rotundifolia*. Shelter Island. *Clinton.*

PUCCINIA DAYI *Clinton n. sp.*

Spots suborbicular, brown, sori prominent, scattered or confluent, brown; spores oblong-clavate, slightly constricted, .0015′–.0023′ long; peduncle slightly colored, one-half to wholly as long as the spore.

Leaves of *Lysimachia ciliata*. Buffalo. *Clinton.*

Very closely related to *P. Gerardii*, differing chiefly in the darker color of the spots and sori. Dedicated to Mr. D. F. Day.

PUCCINIA CLINTONII *n. sp.*

Spots obliterated; sori amphigenous, clustered or scattered, brown; spores oblong, slightly constricted, .0011′–.0014′ long.

Leaves of Pedicularis. Goat Island. *Clinton.* October.

PUCCINIA SORGHI *Schw.*

Leaves of Indian corn. Buffalo. *Clinton.* West Albany.

UROMYCES GRAMINUM *Cooke.*

Leaves of *Bryzopyrum spicatum.* Shelter Island. *Clinton.* September.

USTILAGO DESTRUENS *Duby.*

Spikes of *Setaria glauca.* Bethlehem. Albany county. September.

PROTOMYCES MENYANTHIS *De Bary.*

Leaves of *Menyanthes trifoliata.* Buffalo. *Clinton.* August.

PERIDERMIUM COLUMNARE *A. & S.*

Leaves of Hemlock trees. *Abies Canadensis.* Sandlake. July.

The more elongated peridia and the yellow or orange colored spores distinguish this species from *P. balsameum.*

ÆCIDIUM DRACONTIATUM *Schw.*

Leaves of *Arisæma Dracontium.* North Greenbush. June.

This species occurs also on leaves of *Arisæma triphyllum.*

CYSTOPUS AMARANTHI *Schw.*

Amaranth leaves. Albany. June and July.

STILBUM AURIFILUM *Ger.*

On *Dædalea unicolor.* Poughkeepsie. *Gerard.*

STILBUM CANDIDUM *n. sp.*

White, when dry slightly tinged with yellow, scarcely one line high, scattered, erumpent from minute chinks in

the matrix; head obovate or subglobose; stem slightly tapering upward; spores oblong, colorless, .0004′–.0005′ long.

Dead stems of *Amphicarpæa monoica*. Portville. September. (Plate 1, figs. 25–27.)

STACHYBOTRYS LOBULATA *Berk.*

Damp wall paper. Albany. September.

HAPLOGRAPHIUM APICULATUM *n. sp.*

Flocci simple, septate, black, the tips slightly thickened and papillose; spores almond-shaped, very unequal in size, .0002′–.00066′ long, with a minute apiculus at each end, forming branched moniliform cinereous threads, which diminish in size upward.

Discolored elongated-conical galls of witch hazel leaves. Bethlehem. September. (Plate 1, figs 28–33.)

The galls which this fungus inhabits are those of a plant louse, *Brysocrypta Hamamelidis* Fitch. *Messrs. J. A. Lintner* and *H. F. Bassett.*

MONOTOSPORA BISEPTATA *n. sp.*

Effused, black; flocci erect, simple, septate, slightly thickened at the base, bearing at the apex a single obovate, at first pale and uniseptate, then colored and biseptate spore, .0011′–.0013′ long, .0007′ broad, with the basal cell generally paler than the others.

Decaying wood. Gowanda. *Clinton.* October. (Plate 1, figs. 5–8.)

The specimens are accompanied by *Sphæria hirsuta.*

HELMINTHOSPORIUM URTICÆ *n. sp.*

Flocci forming elongated effused blackish velvety patches, septate, knotty, sometimes slightly branched, the tips paler; spores cylindrical, obtuse, triseptate, colored, about equal in diameter to the flocci, but much shorter, .0006′–.001′ long.

Dead nettle stems. Greenbush. May.

MACROSPORIUM SAPONARIÆ *n. sp.*

Spots arid, suborbicular; flocci short, stout, septate, obtuse, colored; spores oblong-clavate, brown or oliva-

ceous-brown, five to ten-septate, .002′–.0036′ long, including the very short concolorous peduncle.

Leaves of soapwort, *Saponaria officinalis*. Greenbush. September.

The spores are often longer than the flocci.

NEMATOGONUM AURANTIACUM *Desm.*

Cut surface of a birch stump. Lake Pleasant. August.

PERONOSPORA OBLIQUA *Cooke.*

Living leaves of yellow dock, *Rumex crispus*. North Greenbush, October.

PERONOSPORA GERANII *n. sp.*

Effused, sometimes occupying the whole under surface of the leaf, whitish, the flocci irregularly branched, branches short, divaricately spreading, the apices not swollen, furnished with short slender spicules; acrospores globose, .0006′ in diameter.

Living leaves of *Geranium maculatum*. North Greenbush. June.

Related by its spiculose branches to *P. gangliformis*.

ERYSIPHELLA *nov. gen.*

Perithecia destitute of appendages, spores definite.

This genus differs from *Perisporium* in having a definite number of spores in an ascus, and from *Uncinula*, *Microsphæra* and *Erysiphe* in being destitute of appendages.

ERYSIPHELLA AGGREGATA *n. sp.*

Mycelium obscure or concealed; perithecia numerous, densely crowded, subglobose, glabrous, reddish-brown or black; sporangia numerous, ten to twenty, varying from oblong-ovate to subclavate; spores eight, broad, elliptical, .0008′–.0009′ long, .0005′–.0006′ broad.

Fertile aments of alders. North Greenbush. May. (Plate 2, figs. 1–3.)

The perithecia are densely aggregated in the interstices of the aments, giving them a compact blackened appearance. Usually a white meal-like substance more or less involves and, with the crowded perithecia, conceals the mycelium. Sometimes nearly all the aments in a cluster are covered by this fungus.

MICROSPHÆRA PLATANI *Howe.*

Leaves of buttonwood, *Platanus occidentalis.* Yonkers *Howe.*

MICROSPHÆRA SYMPHORICARPI *Howe.*

Leaves of snowberry, *Symphoricarpus racemosus.* Yonkers. *Howe.*

MICROSPHÆRA MENISPERMI *Howe.*

Leaves of moonseed, *Menispermum Canadense.* Yonkers. *Howe.*

MICROSPHÆRA ABBREVIATA *n. sp.*

Mycelium thin; conceptacles small; appendages six to fifteen, hyaline, rough, shorter than the diameter of the conceptacles, many times dichotomous at the tips, the ultimate ramuli curved; sporangia three or four, containing three to five, mostly four, spores; spores large, .001′–.0013′ long, .00066′ broad.

Under surface of dead or languishing oak leaves. Buffalo. *Clinton.* (Plate 2, figs. 4–5.)

Allied to *M. Hedwigii*, from which it is separated because of the short scabrous appendages, etc.

MICROSPHÆRA VAN BRUNTIANA *Ger.*

Living leaves of elder, *Sambucus Canadensis.* Poughkeepsie. *Gerard.* Buffalo. *Clinton.* Oneida. *Warne.* West Albany and Sandlake. July to September.

This species is described as having eight spores in a sporangium, but I have not been able to detect more than four in the specimens which I have examined.

CHÆTOMIUM LANOSUM *n. sp.*

Perithecia small, subglobose, scattered or crowded, densely covered with long woolly hairs, which are either dingy-olivaceous or mouse-colored; asci short, broad, fugacious; spores subglobose, at first pale, then slightly colored, .0003′–.00035′ in diameter, containing a single large nucleus.

On herbarium specimens of grasses. Albany. May.

The soft woolly appearance of the hairs suggests the specific name.

GEOGLOSSUM VELUTIPES *n. sp.*

Subcæspitose, black; club short, compressed; stem densely clothed with a very black velvety pubescence; asci lanceolate; spores fasciculate, at first simple or triseptate, then elongated and nine to eleven-septate, brown, .002′–.005′ long; paraphyses septate, recurved at the tips.

Ground in hemlock woods. Oneida. *Warne.* Northville. August.

This species is easily distinguished both by its somewhat cæspitose habit and its very black hairy stem. The difference between the young and the mature spores is quite noticeable. I have not seen specimens of *G. Walteri*, a hairy species from Australia, but as it is said to have the spores seven-septate it must be distinct from our plant.

PEZIZA ONOTICA *Pers.*

Ground in woods. Williamstown and Northville. August.

P. unicisa is deemed only a form of this species.

PEZIZA REPANDA *Wahl.*

Ground and decaying wood. Croghan. September.

This is not rare in woods and in damp shaded places. It is quite variable in size and in the degree of expansion of the cups.

PEZIZA PALLIDULA *C. & P.*

Decaying beech wood. Croghan. September.

PEZIZA OMPHALODES *Bull.*

Burnt ground. Sandlake. August.

When confluent, as it often is, it has more the appearance of some Corticium than of a Peziza.

PEZIZA FUSICARPA *Ger.*

Ground. Poughkeepsie. *Gerard.* North Greenbush and Williamstown. August.

This, according to specimens received from Dr. Curtis, is the *P. velutina* B. & C. in his Catalogue of North Carolina Plants.

PEZIZA SEPULTA *Fr.*

Sand hills near West Albany. October.

Little openings in the sand reveal the places where these plants lie concealed.

PEZIZA OVILLA *n. sp.*

Small, 1″–2″ in diameter, at first closed and subglobose, then open, cup-shaped or concave, rather firm, minutely tomentose, whitish, the disk sometimes tinged with pink; asci cylindrical; spores fusiform, large, one or two nucleate, .0013′–.0016′ long.

Ground in woods. Sageville. August.

PEZIZA CLANDESTINA *Bull.*

Dead stems of raspberry, *Rubus strigosus.* Sandlake. June.

PEZIZA HYALINA *Pers.*

Decaying wood. Center. June.

PEZIZA CUCURBITÆ *Ger.*

Squashes. Poughkeepsie. *Gerard.*

PEZIZA CINEREA *Batsch.*

Decaying wood. Worcester and Portville. July and September.

PEZIZA CORNEOLA *C. & P.*

Subgregarious, erumpent, soon naked, elevated, pitchy-black, coriaceous or horny; cups at first sphæroid, opening by a narrow paler mouth, opaque, subrugose, at length cup-shaped, margin inflexed, disk pallid tawny-gray; asci clavate or cylindrical; spores narrowly elliptical, binucleate, hyaline, .0004′–.0005′ long.

Decaying stems of herbs. North Greenbush. June.

PEZIZA ATROCINEREA *Cooke.*

Dead stems of Solidago. Albany. June.

PEZIZA SUBATRA *C. & P.*

Gregarious, erumpent, black, soft or waxy; cups at first hemispherical, then open, smooth or slightly rugose, disk fuliginous, margin paler; asci subcylindrical; spores cylindrical, straight or curved, with two or three nuclei, .0006′ long.

Dead stems of herbs. North Greenbush. June.

The species is allied to *P. atrata*, *P. ebuli* and *P. sphærioides*, but it differs in fruit and in the more fibrous structure of the cup.

PEZIZA SCIRPINA *n. sp.*

Minute, scattered, erumpent, glabrous, black externally, paler or grayish within; asci oblong; spores crowded, fusiform, straight or slightly curved, binucleate, colorless, .0008′–.001′ long.

Dead stems of *Scirpus cæspitosus.* Adirondack Mountains. July.

PEZIZA PTERIDIS *A. & S.*

Dead fern stems. North Greenbush. June.

HELOTIUM PILEATUM *n. sp.*

Subhemispherical or pileiform, stipitate, smooth, whitish, under surface flattened and slightly pruinose; stem rather long, white, pruinose; spores oblong, hyaline, .0004′–.0005′ long.

Decaying herbaceous stems in wet places. Hunter, Greene county. June. (Plate 1, figs. 11–14.)

The fresh plant, which is scarcely half an inch high, looks like some very small white Agaricus.

HELOTIUM SALICELLUM *Fr.*

Dead willow twigs. Buffalo. *Clinton.* Dead grape vines. Albany. October.

DERMATEA CINNAMOMEA *C. & P.*

Subcæspitose, erumpent, subsessile, surrounded by the ruptured epidermis, somewhat coriaceous, externally pulverulent, cinnamon colored, margin involute, disk brown, nearly plane, somewhat angular when dry; asci elongated-clavate; spores narrowly elliptical, simple, .0005′ long.

Dead branches of poplars. Shandaken. June.

PATELLARIA FUSISPORA *C. & P.*

Gregarious immarginate, dull black, orbicular, regular, convex, lenticular, somewhat coriaceous; asci cylindrical, attenuated at the base; spores lanceolate, uniseptate at first with each cell binucleate, ultimately brown,

.0008′–0009′ long, .0002′ broad; paraphyses slender, simple, slightly thickened above.

Decaying wood. Portville. September.

PATELLARIA DISPERSA *Ger.*

Bark of *Juniperus Virginiana.* Poughkeepsie. *Gerard.* New Baltimore. *Howe.*

PATELLARIA FENESTRATA *C. & P.*

Scattered, dull black, somewhat soft and waxy when moist, discoid, rather irregular when dry, margin rounded, elevated, contracted when dry, disk plane or convex, sometimes depressed or umbilicate in the center; asci subclavate; spores four to eight, involved in mucus, large, pyriform, multiseptate, fenestrate, brown, .0018′–.002′ long; paraphyses slightly clavate.

Dead branches of poplar. Center. October and November.

This species closely resembles the preceding one, but it is less scattered in its mode of growth, the spores are longer in proportion to their breadth, and are involved in mucus.

SPHINCTRINA TIGILLARIS *B. & Br.*

On *Polyporus abietinus.* Albany. Buffalo. *Clinton.* The spores in our specimens are .0003′–.0006′ long.

CENANGIUM AUCUPARIÆ *Fr.*

Dead branches of mountain ash, *Pyrus Americana.* Keene, Essex county. July.

CENANGIUM RUBI *Fr.*

Dead stems of raspberry. North Greenbush. May.

CENANGIUM DEFORMATUM *n. sp.*

Small, crowded or scattered, at first irregular or subspherical then opening at the top and becoming discoid with an irregular or ruptured margin, black; spores crowded, elliptical, at first pale with the endochrome centrally parted, then colored and uniseptate, .0011′–.0013′ long.

Dead bark of *Juniperus Virginiana.* Greenbush. May.

When young the plants resemble some small irregular Sphæria. They sometimes manifest a tendency to grow in lines.

STICTIS PUPULA *Fr.*

Dead poplar branches. Center. October and November.

STICTIS HYSTERINA *Fr.*

Decorticated pine branches. Guilderland. May.

STICTIS QUERCINA *n. sp.*

Amphigenous, scattered, minute, erumpent, the epidermis split into three or four blunt laciniæ or teeth; disk white; asci subcylindrical; spores filiform, .0016′–.0026′ long.

Fallen oak leaves. Port Jervis. September.
It is related to *S. phacidioides*, from which its amphigenous habit and fewer blunt teeth will separate it.

RHYTISMA URTICÆ *Fr.*

Dead nettle stems. Greenbush. May. Sterile.

HYSTERIUM VIXVISIBILE *Ger.*

Dead branches. Poughkeepsie. *Gerard.*

I am not fully satisfied that this is any thing more than a small variety of *H. angustatum.*

HYSTERIUM CLAVISPORUM *C. & P.*

Dead stems of reeds, *Phragmites communis.* Buffalo. *Clinton.* Tyre. September.

The spores are colored and multiseptate, and by their clavate form suggest the specific name.

HYSTERIUM ROUSSELII *De Not.*

Decaying wood. Tyre and Lake Pleasant. August and September.

HYSTERIUM MAGNOSPORIUM *Ger.*

Decaying hickory wood. Poughkeepsie. *Gerard.*

COLPOMA LACTEUM *n. sp.*

Perithecia scattered, erumpent, thin, black, the longitudinally ruptured epidermis closely appressed; disk plane, milk white; asci subcylindrical or clavate; spores filiform, .002′–.003′ long.

Dead stems of Labrador tea, *Ledum latifolium.* Sandlake. June.

When moist the perithecium gaps widely, revealing the conspicuous white disk. This and the different habit distinguish the species from *Xyloma Ledi.*

AILOGRAPHUM SUBCONFLUENS *n. sp.*

Perithecia, small, numerous, thin, scattered, or subconfluent; orbicular, elliptical or elongated, black; asci oblong; spores oblong-clavate, hyaline, .003′–.004′ long.

Dead stems of herbs. North Greenbush. June.

This appears to the naked eye much like some Leptostroma.

TORRUBIA CLAVULATA *Schw.*

On dead scale insects of black-ash branches. Lake Pleasant. August.

Schweinitz describes his *Sphæria clavulata* as growing on a fibrillose-membranaceous shield-shaped subiculum which adheres closely to the bark of living branches of oak trees, *Quercus palustris* and *Q. coccinea.* Our plant grows on the flattened discolored or blackened bodies of a scale insect found on living branches of *Fraxinus sambucifolia.* Notwithstanding this difference in habitat and a slight discrepancy in the arrangement of the perithecia, the species is so remarkable and so well characterized that I cannot believe our plant to be specifically distinct. It is the smallest Torrubia known to me, and does not well agree with the generic character. It occurs on young and half grown as well as on full grown insects, but I have not been able to determine whether it attacks the insect while living or only after death.

TORRUBIA SUPERFICIALIS *n sp.*

Slender, about 1′ high, smooth, brown, the sterile apex gradually tapering to a point; perithecia crowded, superficial, subglobose, blackish-brown, sometimes collapsed, with a small papilliform ostiolum; asci cylindrical; spores long, slender, filiform.

Under hemlock trees on buried larvæ. Northville. August.

Related to and intermediate between *T. Ravenelii* and *T. Carolinensis.* The stem of the plant is about equal in length to the club or perithecia-bearing part. The perithecia are more loosely placed at the extremities of the club, thereby giving it a subfusiform shape. The spores are more slender than those of *T. Carolinensis* but the plant itself is less elongated and slender.

EPICHLŒ TYPHINA *Berk.*

Living stems of Carex. Oneida. *Warne.*

I do not know that this plant has before been detected in this country.

NECTRIA SANGUINEA *Fr.*

Cut surface of maple wood. Williamstown. July.

HYPOXYLON FUSCOPURPUREUM *Schw.*

Old rails and decaying wood. Sandlake.

HYPOXYLON SASSAFRAS *Schw.*

Bark of *Sassafras officinale.* Yonkers. *Howe.*

DOTHIDEA LINDERÆ *Ger.*

Dead stems of the spice bush, *Lindera Benzoin.* Albany. October.

MELOGRAMMA BULLIARDI *Tul.*

Bark of hornbeam. La Salle, Niagara county. *Clinton.* May.

DIATRYPE ASPERA *Fr.*

Dead stems of Cornus. Tyre. September.

DIATRYPE DISCOIDEA *C. & P.*

Stroma orbicular or elliptical, transversely erumpent, surrounded by the epidermis, disk naked, plane, grayish-black; ostiola small, scarcely exserted, nearly smooth or four to six sulcate, perithecia six to twelve, ovate; asci small, linear-clavate, stipitate, polysporous; spores cylindrical, curved or straight, slightly colored, .0002′ long; paraphyses filiform.

Dead branches of white birch, *Betula populifolia.* Center. October.

When the outer bark is torn away the fungus comes off with it. The species belongs to the subgenus Diatrypella and is closely related to *D. quercina.* There are two forms, one with the stroma small, narrow, and transversely erumpent, the other larger and suborbicular.

DIATRYPE PROMINENS *Howe.*

Bark of *Platanus occidentalis.* Yonkers. *Howe.*

DIATRYPE ANOMALA *n. sp.*

Pustules prominent, subrotund or elliptical, 1″–2″ in diameter, erumpent, penetrating the wood, generally with a thin black crust beneath and around them, the disk convex or slightly depressed, rough, brown or black, sometimes whitish-pulverulent; perithecia crowded, deeply imbedded in the stroma, often elongated; ostiola scattered or crowded, convex, often radiate-sulcate, black; asci short, broad, firgacious; spores crowded, elliptical, simple, often with a nucleus at each end, colorless, .0003′–00035′ long.

Stems of hazel bushes living or dead. Albany. May.
The pustules sometimes appear in long lines or series. The peculiar and anomalous character of this species is found in its unusual spores and in its attacking living stems.

MELANCONIS BICORNIS *Cooke.*

Perithecia circinating, five to seven, seated beneath the epidermis which is but slightly elevated; ostiola short, convergent, just piercing the epidermis, with a regular orifice; spores expelled when mature, blackening the matrix round the ostiola, fasciculate, obtusely fusiform, straight or curved, triseptate, brown, .0026′–.0033′ long, scarcely constricted, ultimate cells smallest, each extremity tapering into a hyaline at first straight then curved or flexuous cornute appendage, one-half to one-third the length of the spore.

Bark of *Platanus occidentalis.* La Salle. *Clinton.* Greenbush. March and May.
Allied to *Melanconis Berkelei* Tul., but distinct. When the epidermis is torn away, the perithecia come off with it. They are slightly whitish-floccose or tomentose above.

VALSA PRUNASTRI *Fr.*

Dead branches of plum or cherry. Greenbush. June.

VALSA RUBI *n. sp.*

Perithecia crowded, irregular, black, white within, forming a small pustule which is covered by the whitened epidermis; ostiola crowded, piercing and generally obliterating

the minute rusty-brown erumpent disk, not prominent, black; asci subclavate; spores eight, curved, simple, colorless, .0003′–.0004′ long.

Dead stems of blackberry, *Rubus villosus*. Forestburgh. September.

The epidermis is paler in the patches where the pustules occur. The disk appears to the naked eye like a minute black dot though it usually contains from eight to sixteen ostiola. The species is clearly distinct from *S. rubincola* Schw.

VALSA WOOLWORTHI *n. sp.*

Minute, erumpent; perithecia two to six, nestling in the inner bark; ostiola crowded, slightly prominent, barely exserted through the longitudinally ruptured epidermis; spores crowded or biseriate, oblong or subfusiform, uniseptate, mostly four-nucleate, nearly colorless, .0004′ long.

Dead oak or hickory branches. Greenbush. May.

The clusters of perithecia are very numerous and usually occur in series, the epidermis being ruptured continuously from one to another. Respectfully dedicated to *Hon. S. B. Woolworth.*

VALSA LEIPHEMIA *Fr.*

Dead oak branches. North Greenbush. May.

VALSA OXYSPORA *n. sp.*

Pustules scattered, subconical, erumpent, blackish externally, surrounded by the triangularly or stellately ruptured epidermis; perithecia sunk to the wood, when broken off leaving a whitish spot circumscribed by a faint blackish line; ostiola few, short; spores crowded or biseriate, colorless, oblong-elliptical, slightly constricted in the middle, uniseptate, quadrinucleate, with a bristle-like appendage at each end, .0006′ long.

Dead oak branches. Sandlake. August. (Plate 2, figs. 26–29.)

VALSA OBSCURA *n. sp.*

Pustules minute, sunk to the wood, erumpent; ostiola three to eight, slightly prominent; asci subcylindrical;

spores crowded or biseriate, simple or obscurely uniseptate, oblong, narrower toward one end, hyaline, with a minute bristle at each end, .0003′ long.

Dead stems of raspberry, *Rubus strigosus.* Albany. May.

The septum is not always clearly visible. When present it divides the spore into two unequal parts.

The appendages are so small as to be easily overlooked.

The bark is generally stellately split over the pustules.

VALSA MUCRONATA *n. sp.*

Perithecia four to eight, rather large, nestling in the inner bark, surrounded by a black line; ostiola separately erumpent, not collected in a disk, slightly prominent, black, sometimes circumscribed by an obscure black line; asci lanceolate; spores crowded, large, uniseptate, colorless, .0016′–.0021′ long, generally with a short appendage or mucro at each end.

Dead willow branches. Sandlake. September. (Plate 2, figs. 10–13.)

This species is very distinct both in its separately erumpent ostiola and in its spores. The appendages are so short as to resemble a little mucro, whence the specific name. It is an aberrant species, the ostiola not agreeing well with the generic character.

VALSA ACERINA *n. sp.*

Pustules small, erumpent; perithecia sunk in the wood, covered above by a thin blackish crust and surrounded by a black line; ostiola prominent, elongated-conical or cylindrical; spores oblong or subelliptical, subacute, colorless, .0005′ long, the endochrome one to three times divided.

Dead branches of *Acer spicatum.* Indian Lake. July.

VALSA SUFFUSA *Fr.*

Dead alder branches. Buffalo. *Clinton.*

VALSA FEMORALIS *n. sp.*

Pustules small; perithecia few, nestling in the inner bark; ostiola few, black, short, erumpent through small and mostly transverse chinks, crowded or scattered; asci

lanceolate; spores crowded, elongated, sublinear, straight or slightly flexuous, obtuse, slightly thickened at the ends, .0013′–.003′ long.

Dead alder branches. West Albany and Greenbush. Also on dead branches of basswood. Buffalo. *Clinton.*

Closely related to *Valsa suffusa*, but the spores are shorter and thickened at each end and the ostiola are not always crowded in the center of the disk. The perithecia adhere to the epidermis and are torn away with it. The name is suggested by the resemblance of the spores to a *femur*.

VALSA SAMBUCINA *n. sp.*

Pustules erumpent, sometimes seriately placed; ostiola slightly prominent, even or radiately sulcate, scattered or crowded; asci linear; spores eight, uniseriate, oblong, colored, triseptate, .0005′–.0006′ long.

Dead stems and branches of elder. Catskill Mountains. June.

When young the spores are paler. The pustules vary much in size, those on the branches being larger and more scattered than those on the main stems or trunks.

CUCURBITARIA ALNEA *n. sp.*

Perithecia cæspitose, erumpent, astomous, black, white within, the tufts closely surrounded by the transversely ruptured epidermis; spores uniseriate, uniseptate, subacuminate, constricted at the septum, nearly colorless, with one or two nuclei in each cell, .0008′–.001′ long.

Dead alders, Center. May.

Torula alnea is associated with this species and may be a condition of it.

CUCURBITARIA SERIATA *n. sp.*

Perithecia cæspitose, erumpent in long flexuous interrupted lines, small, nearly globose, black, white within, sometimes collapsing, the stroma if present merely cortical and subferruginous; asci cylindrical or subclavate; spores uniseriate or rarely crowded, uniseptate, oblong-elliptical, slightly constricted at the septum, hyaline, .0004′–.0005′ long.

Dead bark of Euonymus. Albany. October. *Dr. C. Devol.*

LOPHIOSTOMA JERDONI *B. & Br.*

Bark of elm. New Baltimore. *Zabriskie.* Dead stems of raspberry. West Albany. October.

LOPHIOSTOMA SCROPHULARIÆ *n. sp.*

Perithecia scattered, minute, covered by the epidermis: ostiola small, compressed, piercing the epidermis; asci cylindrical; spores crowded or biseriate, subfusiform, uniseptate, with two large nuclei in each cell, strongly constricted at the septum and sometimes also between the nuclei, straight or slightly curved, colorless, .001′ long.

Dead stems of *Scrophularia nodosa.* Green Island. October.

Sometimes a small additional nucleus is seen at the extremities of the spore, thus making three in each cell. The smaller spores will separate this species from *L. angustilabra* and *L. sexnucleata*, to which it is related.

LOPHIOSTOMA TRISEPTATA *n. sp.*

Perithecia scattered, sunk in the wood, black, with a narrow compressed ostiolum; asci linear; spores uniseriate, rarely crowded, oblong-elliptical, triseptate, colored, .0006′–.0007′ long, slightly constricted at the septa.

Decaying wood. Buffalo. *Clinton.* Sterling. Cayuga county. August.

LOPHIOSTOMA SPIRÆÆ *n. sp.*

Perithecia scattered, sunk to the wood, closely covered by the bark which is pierced by the compressed ostiola; spores crowded or biseriate, elongated-fusiform, straight or curved, colorless, about seven-septate, usually with a nucleus in each cell, .0016′–.0023′ long.

Dead branches of *Spiræa opulifolia.* Rhinebeck. June.

The septa of the spores are not very distinct, especially toward the extremities. The nuclei are not regularly placed, and sometimes one or two very small additional ones occur in some of the cells. Rarely one of the central cells is swollen.

LOPHIOSTOMA MACROSTOMA *Fr.*

Bark of maple trees. Northampton. August.

The spores in our specimens are a little longer than in the European plant, and are occasionally nine-septate. The ter-

minal cells, too, are slightly colored, but paler than the others.

SPHÆRIA CALLISTA *B. & C.*

Dead branches of *Cornus alternifolia*. Buffalo. *Clinton*. Sandlake. Autumn and spring.

I do not know that any description of this species has been published, but our specimens agree with those representing it in Ravenel's *Fungi Exsiccati Caroliniani*. The perithecia become pezizoid-collapsed, and the asci contain numerous small curved colorless spores, as in some species of Nectria.

SPHÆRIA PHÆOSTROMOIDES *n. sp.*

Conidia. Flocci simple or branched, septate, some of them nodose, globosely inflated at the apex ; spores apical, oblong, obtuse, uniseptate, centrally constricted, colored, .0005′–.0007′ long.

Ascophore. Perithecia gregarious, minute, globose, then collapsing, rugulose, seated on a black subiculum ; asci subfusiform ; spores crowded, subfusiform or cylindrical, slightly curved, triseptate, colored, .001′ long, the terminal cells colorless, the others sometimes nucleate.

Dead branches lying on the ground. North Greenbush. September. (Plate 2, figs. 30–35.)

This plant appears to be the American analogue of *S. phæostroma*, from which it scarcely differs except in its shorter spores and uniseptate conidia. So closely does the subiculum of our plant resemble *Cladotrichum triseptatum*, that it might readily be taken for a Cladotrichum with uniseptate spores.

SPHÆRIA SUBCORTICALIS *n. sp.*

Perithecia rather large, thin, sometimes collapsed, black, involved in a dense blackish-brown tomentum which is sometimes confluent, forming a subiculum ; spores oblong, colorless, .0003′ long.

Dead bark of water beech, *Carpinus Americana*. North Greenbush. June.

When the perithecia are crowded the tomentum runs together forming a subiculum, when scattered, it surrounds each separately. They are seated on the inner bark and are entirely concealed by the epidermis. When this is torn away the perithecia usually come off with it. The specific

name is given in allusion to the place of growth. This and the two preceding species belong to the *Byssisedæ*.

SPHÆRIA HIRTISSIMA *n. sp.*

Perithecia scattered or crowded, superficial, ovate or subglobose, black, densely clothed with rather short rigid black hairs; asci linear; spores uniseriate, broadly elliptical or subglobose, colored, .0005′ long.

Decaying pine wood. Center. November.
The perithecia are a little smaller than those of *S. hirsuta*. The asci are quite fugacious. The species belongs to the *Villosæ*.

SPHÆRIA EXIMIA *n. sp.*

Perithecia free, ovate or subconical, clothed with short hairs, black; ostiola smooth, papilliform; spores crowded, elliptical, colored, .001′–.0012′ long, with a very long fine hyaline appendage at each end, the base of one attached to a firm tapering point or process at one end of the spore.

Dung of hares in wet places. Kasoag, Oswego county. July. (Plate 2, figs. 14–17.)
This species is remarkable for the extremely long, slender appendages which are several times the length of the spore.

SPHÆRIA VALSOIDES *n. sp.*

Perithecia sunk in the matrix, scattered, black, with a few rigid bristle-like processes at the apex; asci subclavate; spores crowded or biseriate, oblong-elliptical, at first greenish, then brown, .0011′–.0013′ long, generally with a single nucleus and a short stem-like colorless appendage at the base.

Cow dung. Sageville. August.
The caudate appendage is usually about half as long as the spore. The erect processes at the apex of the perithecia are suggestive of a minute species of Valsa, whence the specific name.

SPHÆRIA MINIMA *Awd.*

Dung of hares. Providence. Also on horse dung. Bethlehem. August and September.

SPHÆRIA CANINA *n. sp.*

Perithecia minute, scattered or crowded, free, subglobose,

reddish-brown or dark amber color, then blackish; asci broad, oblong or oblanceolate; spores numerous, elliptical, slightly colored, .00025′–.0003′ long.

Dung of dogs. Bethlehem. May.

SPHÆRIA ACERVALIS *var.* JUNIPERI *West.*

Dead wood and branches of red cedar, *Juniperus Virginiana.* Buffalo. *Clinton.*

SPHÆRIA MONOSPERMA *n. sp.*

Perithecia scattered, convex or hemispherical, partly covered by the fibres of the wood, smooth, black, pierced; asci oblong or lanceolate, containing a single spore; paraphyses numerous, filiform; spores very large, oblong or subfusiform, obtuse, fenestrate, sometimes obscurely multiseptate, yellowish or pale-brown, .003′–.006′ long.

Decorticated birch wood. Forestburgh. September. (Plate 2, figs. 36–39.)

Remarkable for producing but one spore in an ascus. When young the asci are filled with a granular endochrome which is gradually absorbed in the formation in each of a single large cellular spore which scarcely differs in color from the original contents of the ascus. In the best developed specimens the ostiolum when magnified appears to occupy the center of a small orbicular depressed disk.

SPHÆRIA SCORIADEA *Fr.* *Verrucaria conferta* Tayl.

Dead birch branches. Center. June.

There is some doubt whether this is a fungus or a lichen.

SPHÆRIA PLATANICOLA *Howe.*

Branchlets of *Platanus occidentalis.* Yonkers. *Howe.*

SPHÆRIA PULICARIS *Pers.*

Dead stems of Indian corn. North Greenbush. October.

Not having access to Persoon's description, our specimens were determined by comparison with those in Ravenel's *Fungi Exsiccati Caroliniani.* *Sphæria pulicaris* Fr., now referred to the genus Nectria, seems to be different.

SPHÆRIA RUBEFACIENS *n. sp.*

Perithecia minute, scattered, subglobose, smooth, black, nearly free, abruptly tapering into the long slender subulate

ostiola; asci clavate, fugacious; spores elliptical, colored, .00018′–.0002′ long, .00012′ broad.

Decorticated wood of deciduous trees. Forestburgh. September. Buffalo. *Clinton.*

The surface of the wood on which it grows is variegated with red stains, whence the specific name. The long ostiola crowned by the mass of spores have the appearance of some minute species of Calicium. The plant belongs to the *Ceratostomæ*, and is closely related to *Sphæria pilifera*, but the type of that species grows on pine wood and produces no red stains. Its spores appear to be unknown, and unless they shall be found to correspond with those above described, this must be considered a distinct species.

SPHÆRIA URTICÆ *Rabh.*

Dead stems of nettles. Greenbush. May.

The spores are shorter in our specimens than the dimensions given in the description, but this difference is probably only varietal.

SPHÆRIA DATURÆ *Schw.*

Dead stems of *Datura Tatula.* Buffalo. *Clinton.* October.

SPHÆRIA TUBÆFORMIS *Tode.*

Fallen alder leaves. West Albany. May.

SPHÆRIA MIRABILIS *n. sp.*

Perithecia scattered, innate, subglobose, membranaceous, tough, black, ostiola long, slender, curved or flexuous, lateral; asci broadly fusiform; spores crowded, elongated, subfusiform, hyaline, generally four to many-nucleate, .0011′–.0013′ long, with a slight appendage at one or both ends.

Fallen birch leaves. Bethlehem. June. (Plate 2, figs. 18–21.)

The species is remarkable for its lateral ostiola, which are about equal in length to the diameter of the perithecia.

SPHÆRIA PERISPORIOIDES *B. & C.*

Upper surface of living leaves of *Desmodium Canadense.*

I find no description of this species, and make the determination by comparison with Ravenel's specimens in *Fungi Exsiccati Caroliniani*, with which ours agree in habit,

although his occur on Rhyncosia leaves and are destitute of fruit. To this extent ours must be regarded as doubtful.

SPHÆRELLA OBLIVIA *Cooke.*

Fallen leaves of *Rhododendron maximum.* Buffalo. *Clinton.*

SPHÆRELLA CARPINEA *Fr.*

Fallen leaves of *Carpinus Americana.* Buffalo. *Clinton.* North Greenbush. May.

SPHÆRELLA SPARSA *Awd.*

Fallen leaves of beech and basswood. Buffalo. *Clinton.* Also on chestnut leaves. North Greenbush. May.

SPHÆRELLA INDISTINCTA *n. sp.*

Perithecia minute, innate, slightly prominent, scattered or subgregarious, globose, black; asci subcylindrical, .0014′–.0018′ long; spores crowded, elongated, hyaline, simple or obscurely uniseptate, .001′–.0011′ long, generally slightly curved.

Dead leaves of *Pteris aquilina.* Center. June.

The perithecia are so small as to be easily overlooked. The spores are quite unlike those of *Sphærella Pteridis*, being twice as long and not distinctly septate.

SPHÆRELLA ORBICULARIS *n. sp.*

Perithecia minute, innate, covered by the epidermis which is at length pierced or ruptured, occupying distinct or subconfluent orbicular brownish spots; asci subcylindrical; spores oblong, uniseptate, colored, .0004′–.0005′ long.

Upper surface of fallen poplar leaves. Center and North Greenbush. June.

The spots on the leaves resemble those of *Venturia orbicula* on oak leaves. Sometimes the epidermis peels off revealing the perithecia beneath. These are often more numerous near the margin of the spot than in the center.

VENTURIA MYRTILLI *Cooke.*

Fallen leaves. New Scotland. Albany county. June.

VENTURIA MACULANS *n. sp.*

Perithecia very minute, innate, seated on small irregular more or less confluent grayish-brown spots, crowned by a

few rigid black hairs or setæ; asci rather broad, often narrowed above; spores crowded or biseriate, at first hyaline, then yellowish, uniseptate, with the cells unequal, slightly constricted at the septum, .00035′–.0005′ long.

Fallen leaves of *Betula populifolia*. Center. May.

VENTURIA CLINTONII *n. sp.*

Gregarious in indeterminate suborbicular patches; perithecia nearly free, globose, black, hispid with few straight black bristles; asci linear; spores obovate, uniseriate, uniseptate, yellowish or yellowish-brown, .0004′ long, the septum usually nearest the small end.

Under surface of fallen leaves of *Cornus circinata*. Buffalo. *Clinton*. May. (Plate 2, figs. 22–25.)

The decidedly colored uniseriate spores afford a peculiar character in this species.

VENTURIA KALMIÆ *n. sp.*

Perithecia minute, prominent, centrally aggregated on small orbicular brown spots or scattered along the midrib, black-bristly with straight rigid divergent black hairs; asci subcylindrical, .0013′ long; spores oblong or subfusiform, minutely nucleate, .00035′ long.

Upper surface of living leaves of *Kalmia glauca*. Kasoag. July. (Plate 2, figs. 6–9.)

The affected leaves are the older ones occupying the lower part of the stem.

NEW STATIONS OF RARE PLANTS,

REMARKS AND OBSERVATIONS.

BRASENIA PELTATA *Pursh.*

Mud Pond near the base of Mt. Dix. Also in many other lakes and ponds of the Adirondack region. *V. Colvin.*

SOLEA CONCOLOR *Ging.*

Manlius. *Wibbe.* Pine Plains. *L. H. Hoysradt.* "New Lebanon near the Shaker Settlement." *Beck Herbarium.*

POTENTILLA TRIDENTATA *Ait.*

Top of Stissing Mountain near Pine Plains. *Hoysradt.*

AMELANCHIER CANADENSIS V. OLIGOCARPA *T. & G.*

The fruit of this variety, as it occurs in the Adirondack region, is ellipsoid. It is not quite as juicy and pleasant to the taste as the globose fruit of the other varieties.

NARDOSMIA PALMATA *Hook.*

Buttermilk Glen, Ithaca. *Prof. Prentiss. G. W. Wood.* Machias, Wyoming county. *Clinton.*

RHODODENDRON MAXIMUM *L.*

Machias. *Clinton.* Also near West Hurley, Ulster county.

PRIMULA MISTASSINICA *Mx.*

Fall Creek Gorge, Ithaca. *Prof. Prentiss.*

PINGUICULA VULGARIS *L.*

Cascadilla Ravine, Ithaca. *Prof. Prentiss.* Portage. *Clinton.*

AMARANTUS SPINOSUS *L.*

Waste places about Brooklyn. *M. Ruger.*

ARCEUTHOBIUM PUSILLUM *Pk.*

Kasoag, Oswego county; also Providence, Saratoga county, thus making five counties in the State in which this plant has been found. In all these localities it inhabits spruces in low grounds or marshes. At Kasoag there are a few dead trees giving evidence of having been inhabited by this parasite to which possibly their death is due.

ABIES BALSAMEA *Marshall.*

This occurs in the Stony Clove, Catskill Mountains, in a prostrate or ascending bush-like form resembling the common juniper, the American yew and the prostrate form of the black spruce as it is found on the high Adirondack summits.

ARISÆMA TRIPHYLLUM *Torr.*

This plant with us is quite constantly diœcious. During two or three successive seasons I have examined scores of plants in various localities in the vain effort to find a specimen with monœcious inflorescence. Can it be that the monœcious character is giving way, under altered climatic conditions, to a diœcious one?

TRILLIUM ERECTUM V. ALBUM *Pursh.*

Ithaca. *Prof. Prentiss.*

ALLIUM CANADENSE *Kalm.*

Alluvial banks of the Hudson. North Greenbush. June.

SCLERIA VERTICILLATA *Muhl.*

Near Woodside, Long Island. *Kruger.* Mr. Kruger observes that the fresh plant has a pleasant vanilla-like odor. Rev. J. A. Paine also speaks of its fragrance.

ORYZOPSIS CANADENSIS *Torr.*

Sandy soil near Center.

POA ALSODES *Gray.*

Shaded banks. Catskill Mountains.

MILLIUM EFFUSUM *L.*

Stony Clove, Catskill Mountains.

PANICUM AGROSTOIDES *Spreng.*

Near Northampton, Fulton county.

ASPIDIUM NOVEBORACENSE V. FRAGRANS.

New Pond, Essex county. *Mrs. L. A. Millington.* Mrs. Millington observes that the fronds are very tall, "sometimes three feet high," that the sori at length spread over the whole under surface and that there is a marked vanilla-like odor which persists even in the dried specimens.

LYGODIUM PALMATUM *Sw.*

Hunter. This, so far as I know, is the only New York station for this rare fern. The credit of its discovery belongs, I believe, to *Miss M. C. Reynolds.* Fertile specimens have been sent me by *Mr. J. T. Lockwood.*

BOTRYCHIUM LANCEOLATUM *Angst.*

Near Northampton and Northville. August.

AZOLLA CAROLINIANA *Willd.*

Black Creek near Oneida Lake. *Warne.*

PANNARIA PETERSII *Tuck.*

The specimen reported under this name and also those reported as *Verrucaria pinguicula* Mass. are not in good condition and therefore uncertain. *Willey.*

AGARICUS ADMIRABILIS *Pk.*

A variety with brown pileus and white stem was found at Lake Pleasant associated with the typical form.

AGARICUS SYLVATICUS *Schæff.*

Ground under pine trees. Northampton. August.

CORTINARIUS SQUAMULOSUS *Pk.*

This species was discovered in 1869 and had not since been observed by the writer until the past season. It is manifestly a species of rare occurrence.

PHALLUS IMPUDICUS *Fr.*

When this plant begins to decay the odor is extremely offensive and not unfrequently is the first intimation given of the presence of the fungus. The carrion beetle, *Necrophila Americana*, sometimes feeds upon this loathsome substance, doubtless deeming it equal to putrefying flesh.

PHYSARUM CÆSPITOSUM *Pk.*

Since the publication of this species I find that the name was preoccupied, and as a reexamination shows it to be a better Licea than Physarum, I would substitute *Licea cæspitosa* Pk. for the above name.

PUCCINIA MESOMAJALIS *B. & C.*

The species published under this name has been redescribed in Grevillea, by Rev. M. J. Berkeley under the name *Puccinia mesomegala* B. & C.

USTILAGO MONTAGNEI *Tul.*

On *Rhynchospora glomerata*. Long Island. *Miller.*

The spores are a little larger than in the form found on *R. alba.* It is probably *U. Montagnei* var. *major* Desm.

PHRAGMIDIUM MUCRONATUM *Lk.*

The typical form occurs on rose leaves in Oneida. *Warne.*

American specimens generally have the spores more opaque and with two or three more septa than the typical form. This variant form might be called var. *Americanum.*

PERIDERMIUM ELATINUM *A. & S.*

Glens Falls. *Mrs. Millington.* Also in Stony Clove, Catskill mountains. Thus far we have seen it on the leaves of the balsam only, and several interesting and peculiar features are indicated. Unlike our other species this one attacks *all the leaves* on an affected branch. These have a sickly yellowish hue, stand out on all sides of the branch and do not attain more than half their usual size. They fall off each year so that leaves are found only on the *terminal* shoots of the affected branches, the internodes of the previous years being entirely destitute of foliage. The fungus therefore appears in reality to be *perennial*, for having once attacked a branch it reappears year after year on the successive crops of leaves, apparently loosening its vampire-like hold only upon the death of the branch. Fortunately it spreads only *outwardly* or in the direction of growth. Hence all the affected branches of a tree if traced back will be found to have a common origin and at this common starting point there is usually a swollen or seemingly injured place in the main branch. From this point the ramification becomes excessive and crowded, exactly similar to that so often seen in spruce trees when attacked by *Arceuthobium pusillum.* All the branches given off below this point are unaffected, all given off above it are affected. Whether the fungus originates this affected point in the branch or not is yet a question, also how long an affected branch will continue to live and support its parasite and whether by the application of sulphur or any other antidote the fungus may be killed and the life of the branch preserved. An obvious remedy would be to cut off the branch below the affected point.

MORCHELLA ESCULENTA *Fr.*

This species, with us as in Europe, is quite variable. The most common form about Albany is whitish or pallid throughout and answers to the variety *rotunda* except in the form of the pileus which is obtusely conical rather than rounded. Whenever I have met with this form it has been under or in the vicinity of pine trees. Another form has

the pileus narrowly conical and darker colored than the stem, which is frequently equal to the pileus in diameter. This is nearest the variety *conica*. It has been found at Albany, *Prof. J. Hall*, and near Utica, *Hon. H. Seymour*. A third form has the stem quite long, even exceeding the pileus in length. It merits the name of variety *longipes*. I have seen dried specimens only and do not know the color of the fresh specimens. They were collected near Oneida by *H. A. Warne*.

SPATHULARIA FLAVIDA *Pers.*

There are two varieties of this, one having a pale or whitish stem, the other having a reddish-brown or bay stem. I do not find the pileus hollow, though it is said to be so in some descriptions.

GEOGLOSSUM GLUTINOSUM *Pers.*

Our specimens were erroneously referred to this species, the description on which we relied making no mention of the fruit. Our plant has been separated by reason of the different spores and is *Geoglossum Peckianum* Cooke.

TORRUBIA OPHIOGLOSSOIDES *Tul.*

Northville and Lake Pleasant.

XYLARIA CORNIFORMIS *Mont.*

A variety occurs with the club irregular and much flattened or compressed. It might be called variety *irregularis*.

HYPOXYLON MORSEI *B. & C.*

There is a variety of this in which the stroma is confluent in patches an inch or more in diameter. It is found on dead poplar branches. Sandlake.

DOTHIDEA PTERIDIS *Fr.*

Mrs. Millington sends an early state of this plant in which there are no asci but numerous spore-like bodies (spermatia ?) oblong, colorless, .0004′–.0005′ in length. When moist they ooze out and form a whitish or pale amber-colored globule.

MELANCONIS ELLIPTICA *Pk.*

Further observation induces me to place this species in the genus Diatrype. The spores are sometimes .0018′ long. When young they are six nucleate.

In the preceding pages when no name is added to the station or stations the plant has been found therein by the writer. Dates signify the time of collecting the specimens and therefore indicate to some extent the time of the occurrence of the plant.

Grateful acknowledgments are rendered to those Botanists whose names appear in the preceding pages, for their kind aid and their generous contributions of specimens.

Respectfully submitted,

CHARLES H. PECK.

ALBANY, *January* 13, 1875.

PRELIMINARY NOTICE OF THE DISCOVERY

OF THE REMAINS OF THE NATATORY AND BRANCHIAL APPENDAGES OF TRILOBITES.

BY C. D. WALCOTT.

In making sections of trilobites, from the Trenton Limestone, at Trenton Falls, N. Y., specimens were used, which were embedded in rocks varying in their character, from the common gray to the dark, fine grained, bluish-gray limestone. In only two layers of a fine, bluish-gray sediment, were trilobites found, which had structural remains preserved beneath the dorsal shell.

The remains, with the exception of the hypostoma, appear to be of a semi-calcified nature, as if a thin membrane had inclosed them until the organic substance had been replaced. Frequently all traces of structure are destroyed by the presence of crystalized calcite. The species *Asaphus megistos*, *Calymene senaria*, *Ceraurus pleurexanthemus*, and *Acidaspis Trentonensis*, have afforded evidence of the presence of organic structure beneath the dorsal shell; *Ceraurus pleurexanthemus* and *Calymene senaria* furnishing the greater portion of the evidence.

Twenty-one individuals of the species *Ceraurus pleurexanthemus*, show the axial appendages. Each segment of the thorax, of the pygidium and the three posterior of the head, have a pair beneath the axial processes. The appendages beneath the thorax and pygidium, appear to be, from transverse and longitudinal sections, short, unjointed, cylindrical supports for swimming lobes, or the remains of rudimentary, ambulatory legs. The three pair of appendages beneath the head, present an obscurely jointed structure. Twelve specimens of *Calymene senaria* show the axial appendages. One individual has twenty-one on one side. The appendages in

this species appear to be attached to the ventral surface of the visceral cavity, while in *Ceraurus pleurexanthemus* they are either attached to the axial processes, or were attached to the thin membrane which must have extended outward from the axial lobe beneath the pleural lobes. Sections of forty-one trilobites of the above species show two hundred and eighty-eight axial appendages.

In sections of fifteen individuals of the species *Ceraurus pleurexanthemus*, remains of the branchial appendages have been found. They occur beneath the pleural lobes near the union with the free pleuræ. In nine sections of the fifteen trilobites, in which these appendages have been discovered, forty-three distinct appendages are to be seen. Transverse sections of the trilobite show the appendage to be a row of obliquely inclined bars, arranged one beneath the other, under the pleuræ. Three sections show the support to which the bars were attached. This support must have been of a fleshy character, probably muscular, as in most of the sections where the bars are in position, the support is not to be seen. The greatest number of bars seen in position, belonging to one appendage, is fourteen. It is very rare to find them in position at all. Longitudinal sections at the union of the pleural lobes and free pleuræ, show the branchial appendages as rows of dots, varying from square to oblong in shape. One section shows forty-eight such dots. The branchial appendages were longer, by one-half, than the axial appendages. A section of *Calymene senaria* shows the branchial appendages in position. They appear to be the same as those of *Ceraurus pleurexanthemus*. Numerous central longitudinal sections of *C. pleurexanthemus*, show the membrane covering the visceral cavity beneath the axial lobe. In coiled specimens it is corrugated by the folding. Several sections show that there was a thickening of the membrane opposite each thoracic segment. One section has eight such thickenings, or membraneous arches. Sections cut through the pleural lobes, have not, as yet, given evidence of the presence of a ventral membrane.

Sections of *Acidaspis Trentonensis* show it to be closely related to *Ceraurus pleurexanthemus*, in the structure of its ventral surface.

From the evidence obtained from sections of *Asaphus (gigas) platycephalus*, and the paper published by Prof. E.

Billings,* it appears that the ventral surface in this species was strengthened by arches, to which the double row of appendages were attached.† From the evidence thus far obtained, the conclusions are, that trilobites swam on their backs (see notes on *Ceraurus pleurexanthemus*, Ann. Lyc. Nat. Hist., N. Y., Vol. XI, p. 155, November, 1875), and that they had a double row of appendages on each side of the central axis.

The central or axial series were either the attachments of swimming lobes, or rudimentary, ambulatory, legs. The lateral series were branchial in their structure, the bars serving as points of attachment for their lamellæ. It is probable that they were also used in swimming. Many sections show appendages beneath the head, but nothing satisfactory can be established from them. As the writer has a large amount of material from the same locality, which is unworked, he hopes to present in a future article a series of descriptions and illustrations, giving the structure of the ventral surface and appendages of the trilobite.

TRENTON FALLS, *May* 26, 1876.

Note of Additional Evidence Obtained since the above was Written.

Additional evidence, obtained from sections of *Calymene senaria*, proves that the central, or axial, appendages, were articulated to the thickened arches of the ventral membrane, on a line with the outer edges of the alimentary canal. The structure of the appendages, as shown in numerous microscopic, transparent and opaque sections, leads me to the conclusion that they were the support of swimming lobes. What may have been a portion of the swimming lobe has been seen in several sections near the end of the appendage. These appendages terminate either in a round blunt point or else appear as if crushed. The form and outline of the swimming lobe could not well be preserved. Transverse sections show the ventral membrane between the axial appendages, the space occupied by the alimentary canal, and the axial and branchial appendages. The branchial appendages were attached

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* Notes on some specimens of Lower Silurian Trilobites, by E. Billings, *Quarterly Journal Geological Society*, November, 1870.

† A conclusion also given by Messrs. Dana, Verrill and Smith, after examining Prof. Billings' specimen. *Am. Jour. S. & A.*, 3d series, I, p. 320.

to the sides of the visceral cavity, just above the axial appendages; they are longer than those of *Ceraurus pleurexanthemus*, and somewhat modified. In that species, they are attached beneath the pleural lobes and curve forward and downward, while in *Calymene senaria* they extend outwardly beneath the pleural lobe, following its curvature nearly to the extremity of the pleuræ. It is on the evidence furnished by three sections, that the conclusion is reached, that a second branchial appendage was attached on each side just below the other. A section of a partially coiled specimen shows fine branchial appendages on each side, brought into this position by the rolling up of the animal. These sections show that the axial are but one-third the length of the branchial appendages. The perfect state of preservation of the delicate branchial appendages and the ventral membrane precludes the idea of the destruction of any thing of a stronger texture than fleshy swimming lobes attached to the axial appendages. The axial appendages could not have reached to the surface upon which the edges of the pleuræ rested, which negatives the view of their being in any way ambulatory, in case the non-presence of articulations, in the appendages, should be called in question. The axial appendages of each series approximate each other near the posterior end of the hypostoma. What may be called oral appendages extend out between the hypostoma and the dorsal shell, or else they were articulated to a membrane connecting the hypostoma and dorsal shell of the head.

Of over two hundred trilobites, which have furnished evidence of appendages, etc., all were resting with the dorsal surface downward.

N. Y. STATE MUSEUM OF NAT. HIST.,
December, 1876.

DESCRIPTIONS OF NEW SPECIES OF FOSSILS

FROM THE TRENTON LIMESTONE.

By C. D. WALCOTT.

CONULARIA Miller MS. (1818).

Conularia quadrata *n. sp.*

Slender, pyramidal, quadrate; angles sulcate; surface marked by oblique transverse ridges which alternate upon opposite sides of a central longitudinal ridge; the transverse ridges are sharp near the apex, growing broader at the mouth, toward which they incline; each side is slightly depressed along the central ridge.

Formation and locality.—Upper third Trenton Limestone, Prospect Bridge, Oneida Co., N. Y.

CONCHOPELTIS *Gen. nov.*

(*Κογχη — shell; πελτη — shield.*)

Shell univalve, patelliform, more or less conical, apex central or subcentral; surface vertically striated, in older specimens marked by concentric lines of growth.

The shell was of a membraneous character. A crushed individual shows two sides doubled at an acute angle, while a split extends nearly to the apex. The substance of the shell is not preserved in any specimens found.*

Conchopeltis alternata *n. sp.*

Margin undulated, nearly equally four-lobed, margin of each lobe slightly contracted at the center, height one-fifth the diameter. Surface marked by concentric lines of growth,

* Associated Lamellibranchiates, and Gasteropods, *Bellerophon bilobatus*, *Bucania bidorsata*, etc., have the shelly structure preserved.

vertically by strong radiating striæ, extending from near the apex to the margin; shorter interstitial striæ alternate near the margin.

The shell was thin and readily distorted by pressure. Of seven entire individuals, two only appear to be in a normal condition; the others are compressed, so that the apex of each is placed in a different position, with relation to any given portion of the margin.

Formation and locality.— Trenton Limestone, upper third. Trenton Falls, N. Y.

CONCHOPELTIS MINNESOTENSIS *n. sp.*

Shell obtusely conical; base slightly elliptical; apex excentric, variable in different individuals; height one-half the greatest diameter. Shallow undulations of growth occur one-half the distance to the apex, finer lines near the margin. Substance of shell not preserved.

The casts preserving the lines of growth indicate the same character of shell as that of *C. alternata*, from the Trenton Limestone of New York.

Formation and locality.— Trenton Limestone, four miles below Medford, Canon River, Minn.

BATHYURUS BILLINGS *

BATHYURUS LONGISPINUS *n. sp.*

General outline oval, strongly convex. Head semicircular, convex; width twice the length, margin broad, slightly con-

* As specimens of different species of BATHYURUS, present characters of the genus BATHYURELLUS *Billings*, and ASAPHISCUS *Meek*, a comparison of the three genera has led me to the conclusion, that BATHYURELLUS and ASAPHISCUS have been separated from BATHYURUS on specific, rather than generic differences. Professor Billings gives, as the generic difference of BATHYURUS and BATHYURELLUS, that the former, as represented by the typical species *B. extans* Hall, *B. Nero* and *B. Cybele* Billings, has a subcylindrical glabella, rounded in front, strongly convex and with obscure glabellar furrows; while in the latter the glabella is conical or pointed in front and exhibits no traces of glabellar furrows; the pygidium also, differs in not being strongly convex, in having a shorter axis, and, in general, a wider border. Professor Meek gives, as the generic differences of ASAPHISCUS and BATHYURELLUS, the decidedly depressed conical glabella, the margin of the head, first convex and sloping forward into a deep, transverse, mesial furrow, then rising in the form of a convex margin to the front, the mesial lobe of the pygidium being also proportionally longer, and the free margins of the same much narrower, and less flattened and alate. BATHYURELLUS can hardly claim the title of subgenus, as given by its author. The presence of faint glabellar furrows, conical glabella, grooved pleuræ, nine thoracic segments, and pygidium of the same character in all essential particulars, clearly indicates, according to the description of the author, that ASAPHISCUS is not to be separated from BATHYURUS by generic characters.

cave, posterior lateral angles produced into long flattish spines, composed of the extended marginal rim and a broad extension of the lateral halves of the occipital segment, giving a slight concavity to the outer surface, slightly incurving and tapering to acute points, terminating opposite the pygidium at its posterior third. Glabella prominent, oblong, convex, broadest at the center, anteriorly rounded and somewhat abruptly curved downward, separated from the cheeks by shallow dorsal furrows. Occipital segment broad, well-defined, thickened at the posterior margin, separated from the glabella by a broad shallow furrow, which, narrowing, extends back of the eyes, two-thirds the distance from the base of the glabella to the lateral margins of the head. Eyes large, prominent, sublunate, visual surface finely reticulated.* Movable cheeks subtriangular in form, sloping rapidly from the base of the eye to the margin, upper angle truncated to form the base of the eye. Facial suture, cutting the occipital segment at its posterior edge on a line with the outer margin of the eye thence passing obliquely inward to the posterior angle of the eye, and curving outward around the top of the eye to the anterior angle, it curves down, with a slight outward obliquity, to the inner edge of the border, then curving forward terminates opposite the widest part of the glabella upon the frontal margin.

Thorax: axial lobe, strongly convex, the segments, nine

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* The facets are arranged upon the visual surface in oblique lines, the crossing of which gives the reticulated appearance. The outer corneas in all specimens examined were absent, which left the facetted surface exposed. The facetted surface of the eye of *Asaphus platycephalus*, has essentially the same arrangement; a short hexagonal prism extends from each facet to the inner surface of the eye, perpendicular to the surface of the facet to which it belongs. The prisms are closely arranged, each side resting against a side of each of the six surrounding facets. The cornea is smooth upon its outer surface, and closely and firmly attached to the facetted surface. In trilobites that have attained their growth the cornea is usually opaque; in younger specimens it is thinner and shows the facetted surface through it, or else bears the impression of the facets upon its outer surface. The fortunate discovery of a specimen showing the interior of both eyes, and, on a section, the prismatic structure and cornea, has enabled me to determine the structure of the eye with accuracy.

The visual surface of the eye of *Bathyurus longispinus* has an area of .0461 of a square inch; area of one facet, 1-102400 of a square inch; number of facets in eye, 4,720. Size of head; length, 1 inch, breadth, 1⅜ inches.

Area of visual surface of the eye of *Asaphus platycephalus*, .0736 of a square inch; area of one facet, 1-102400 of a square inch; number of facets in eye, 7,536. Size of head; length, 1⅜ inches, breadth, 2⅜ inches.

The eye of *Ceraurus pleurexanthemus* was found to have four hundred facets; the arrangement of the prisms is the same as in *Asaphus platycephalus*. Each facet is slightly convex upon its outer surface; the cornea covering the facetted surface partakes of the convexity of each facet, hence the peculiar granulated visual surface, noted by Professor Hall, Pal. N. Y., Vol. 1, p. 242

in number, arch slightly forward, pleural lobes flat for one-half the width, where they curve downward with a slope of about forty-five degrees to the extremities of the segments, the pleuræ of each segment terminating in blunt extremities, a strong pleural groove extends from the anterior inner margin to the lower edge of the curve a little back of the center of the pleura. Anterior margins of the pleuræ depressed, permitting them to lap beneath those of the preceding segment when the animal was coiled.

Pygidium broadly semicircular, convex, with the anterior lateral angles obliquely truncated; axial lobe subconical, extending two-thirds the distance from the anterior to the posterior margin; two axial rings cross the anterior third; pleural lobes, with the exception of a level triangular space each side of the axial lobe, slope rapidly from the axial lobe to the margin, slightly concave all around between the triangular spaces and the margin; three well-defined segments besides the half-segment joining the thorax, extend outward across the triangular spaces and then curve downward and backward, increasing in width toward the margin. Surface: glabella, cheeks and occipital segment finely tuberculated, the remaining parts are ornamented with fine waving lamelliform striæ.

Formation and locality.— Black River Limestone, Trenton Group, Quarry of William Buck, Esq., Russia, Herkimer Co., N. Y. This species also occurs in the Trenton Limestone at Plattsville, Wisconsin.

ASAPHUS BRONGNIART (1822).

ASAPHUS ROMINGERI *n. sp.*

Head semicircular, convex; margin narrow, concave, with a wire-like rim rising somewhat abruptly; postero-lateral angles produced into strong spines, slightly concave upon the outer surface. Glabella: central portion obovate, subacute behind, broadly rounded in front, separated from the fixed cheeks by shallow furrows; two slight, elongate elevations extend obliquely forward from each lateral third of the posterior third of the glabella; upon the depressed posterior portion of the glabella are three tubercles, equidistant between the convex obovate portion and the occipital segment, the central one rising in a short spine. Occipital segment separ-

ated from the glabella by a shallow furrow, merging into the fixed cheeks laterally ; occipital node minute, central ; fixed cheeks broadly expanded in front, contracting nearly to the glabella at the anterior angle of the eye; at the posterior margin uniting with the occipital segment and forming a lanceolate point extending beyond the outer margin of the eye, and curving downward and slightly backward : palpebral lobes large, somewhat depressed at the center ; movable cheeks subtriangular, crowned by the eye, postero-lateral angles with a terminal spine.

Surface ornamented with peculiar elevated tortuous striæ.

The cast of a head shows the movable cheeks attached to the central portion of the head. Numerous detached movable cheeks occur in the same layer with the separated glabella.

Formation and locality.— Black River Limestone, Quarry of William Buck, Esq., Russia, Herkimer Co., N. Y., also, in the Trenton Limestone at Quimby's Mill, Lafayette Co., Wis.

ASAPHUS WISCONSENSIS *n. sp.*

Head semicircular, convex ; postero-lateral angles produced into strong broad spines ; margin broad, slightly concave, the concavity continuing on the spines. Glabella: central portion turbinate, subquadrate in front ; three tubercles occur equidistant between the turbinate glabella and occipital segment. Occipital segment scarcely defined by a shallow groove ; palpebral lobe large, with a depression between the center and margin ; fixed cheeks expanded in front, contracting at the eye and forming acute points at the posterior margin ; movable cheeks subtriangular, crowned by the eye.

Formation and locality.— Same as *A. Romingeri*, and also found in the Trenton Limestone at Mineral Point and Platts-ville, Wis.

This species differs from *A. Romingeri* by having a wider and less concave margin, with the glabella more convex and subquadrate in front. Varietal differences occur between individuals of the same species from New York and Wisconsin ; but as far as the specimens at hand indicate, these are not of specific importance.

THE FAUNA OF THE NIAGARA GROUP, IN CENTRAL INDIANA.

By JAMES HALL.

A paper upon this subject was read before the Albany Institute, April 29th, 1862, and published in Volume IV of its Transactions. An abstract was issued, as a separate pamphlet under date of May 2d, 1863, entitled, "*Notice of some New Species of Fossils from a Locality of the Niagara group in Indiana, with a List of Identified Species from the Same Place.*"

A revision of this paper, with description of additional species, was in preparation at the time the Documentary edition of this report was being printed, but owing to the requirement for publishing the volume of "*Illustrations of Devonian Fossils*" during the same year (1876), it was impossible to complete this paper in time for the publication of that report. The plates illustrating the fossils, with names of species, and explanations of figures having been prepared, were issued with that edition. Since no copies of the report were ordered for the State museum until 1878, it has given an opportunity of revising the published matter of 1863, with additional knowledge derived from subsequent collections, and of adding descriptions of the Corals and Bryozoa not included in the original paper.

The species herein described and figured are all from a single locality on Conn's Creek in the town of Waldron, Decatur county, Indiana, where the calcareous shales of the group, with some thin seams of limestone occur. Many of the same species are found in more calcareous beds at the neighboring locality of St. Paul in the same county, and also at localities farther south on Conn's Creek.

Since the publication of the original paper, a series of the specimens therein described has been placed in the State Museum, and later collections have enabled us to increase the series, so as to include not only all the species of this paper, but to add a considerable number of new forms, the descriptions of which are now being printed in the current volume (X) of the *Transactions of the Albany Institute.*

These new forms, with some additional material of similar character, will form the subject of a supplementary paper in a future report of the State Museum.

The investigation has proved an interesting one, especially as an aid to our knowledge of the geographical distribution of the Niagara fauna.

In the *Twentieth Report on the State Cabinet of Nat. Hist.*, I have given a pretty full illustration of the predominant forms of this fauna as represented in the Niagara formation of Wisconsin, where the prevailing rock is a magnesian limestone. Dr. F. Roemer, in his *Silurische Fauna des Westlichen Tennessee*, has given an illustration of the fauna of this period as known in that State. To these publications we may add volume II of the *Palæontology of New York*, which illustrates the fauna of the Niagara period in its typical locality, and we have the means of comparison between the prevailing forms from four widely separated regions.

Comparing the collections from Waldron, we find a greater proportion of species identical with those of New York than in any other western locality, while the new forms are of the same genera, and often quite nearly allied to those of the Niagara region. It is a little remarkable, however, that while we have in the Indiana locality, twice as many crinoidal forms as in New York, and more than ten times as many individuals, we have not seen a single specimen of CARYOCRINUS, which is the most abundant form among the crinoidea in New York, occurring also in Wisconsin and Iowa quite frequently, and is more abundant in Tennessee than in any of the other localities. The physical conditions originally existing at Waldron were more similar to those of Western New York, than to those of any other locality. In Wisconsin and Iowa, the outcrops are chiefly of magnesian limestone, and the Gaseropoda and Cephalopoda predominate over other forms,

while the Cystidæ are almost equally conspicuous with the Crinoidea. At the Waldron locality, cystidean forms are extremely rare, and but few are known in Tennessee; and though not abundant in New York, there are here more species known than in both the other localities named. I conceive, however, that in this comparison we are not dealing with the same beds in each one of these localities. While I regard the prevailing fossiliferous beds in western New York as essentially parallel with those of Waldron and of Western Tennessee, those of Wisconsin and Iowa are to a considerable extent of newer age, being the higher beds of the series, while the others occupy the lower and middle portions of the formation.*

It would appear from what we know of the physical conditions of this ancient sea, that it was generally shallow and the bottom extremely uneven.

The Niagara group in its easterly outcrop, from Eastern New York to Virginia, indicates a nearly uniform shallow sea, with the deposition of calcareous beds of magnesian character, which, in their south-western extension, become in part replaced by, or alternate with, argillaceous deposits. Along this line the formation is everywhere thin, and, in fact, is so inconspicuous, that it has usually been considered only as a subordinate member of the succeeding formation. It is here usually marked by the presence of a few species of corals, which are extremely abundant, some forms of brachiopods, a few lamellibranchs, gasteropods and cephalopods, and more rarely some remains of trilobites. These are of forms identical with, or nearly allied to, those which characterize the formation in its more western localities. In a westerly direc-

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* The relations of the different members of the Niagara formation, in Wisconsin, Iowa and other western localities, with those of New York, have not been fully determined. It is known that in Canada West the limestones of the lower part of the formation acquire a greatly increased thickness over the same beds in Western New York; and that they likewise include the limestones of the Clinton group, since they are characterized by the presence of *Pentamerus oblongus* and some other Clinton forms of New York. In their western extension these limestones gradually lose their shaly partings and the thin seams and beds of shale, becoming massive and of a nearly uniform ashen or drab color. In this condition the entire mass is recognized as a part of the Niagara formation, and the Clinton group is restricted in its acceptation, to arenaceous and shaly beds, sometimes with thin calcareous bands, corresponding more nearly in physical characters with the same formation in Herkimer and Oneida counties in the State of New York.

tion, within the limits of New York, the formation has a very moderate development until we reach the eastern part of Wayne county, where the shaly member of the formation becomes marked and gradually increases in thickness to Niagara county; the superior limestone increasing in thickness in the same direction. The shaly fossiliferous beds, which are so conspicuous a feature on the Genesee River at Rochester, in Wayne and Niagara counties, and upon the Niagara river, thin out to a great extent within fifty miles west of the river, and are nowhere met with along the outcrops in a westerly and north-westerly direction. This shaly member of the formation was apparently deposited in a wide, shallow depression in the bed of the ancient ocean, which became gradually filled with fine calcareous mud, and which, during this slow process, afforded opportunity for the development of a most abundant fauna.

In Indiana, also, these shaly beds were probably deposited in a wide depression of the ocean bed, similar to that of western New York, while the area to the northward was a more shallow sea. We have a less accurate knowledge of the physical conditions which prevailed to the south and southwest of the localities named ; but it would appear, from what we know of the distribution of the fossils, that there were similar areas of depression with a most abundant fauna, while the intermediate shallower areas are marked by the presence of calcareous deposits, with a moderate development of a somewhat distinct fauna, in which corals are usually conspicuous, and carrying the aspect of an interrupted and imperfectly developed coral reef.

PROTOZOA.

RECEPTACULITES *De France.*

RECEPTACULITES SUBTURBINATUS.

Plate 3, Figs. 1–3.

Receptaculites subturbinatus HALL. Transactions of the Albany Institute, vol. iv, p. 224. Abstract, p. 30; May, 1863.

Body small, or sometimes approaching the medium size of species of this genus; subhemispheric or depressed subturbinate; base of attachment broad; upper side flat or slightly depressed in the middle for a space of about half the diameter, thence curving outwards and downwards to the periphery; cell-apertures on the sides and exterior portions of the upper surface distinctly rhomboidal, the width from the lateral angles being greater than the height; cell-margins very prominent; the cells in the central portion obscure.

This small species, in the specimen originally described, has a diameter of nearly 25 mm., with a height about half as great. It differs essentially from any of the species previously known to me, but approaches in character to the *R. hemisphericus* of the Niagara formation of Wisconsin.

ASTYLOSPONGIA *Roemer.*

ASTYLOSPONGIA PRÆMORSA *Goldf.*

Plate 3, Figs. 4–11 and 14.

Siphonia præmorsa GOLDF. Petref. Germ., i, 17, t. 6, f. 9. 1826.
Siphonia excavata GOLDF. Petref. Germ., i, 17, t. 6, f. 8. 1826.
Siphonia præmorsa HISINGER. Leth. Suec., 94, t. 26, f. 7. 1837.
Siphonia præmorsa EICHWALD. Silur. Schichtensyst. in Esthland, 209.
Siphonia præmorsa MAXIMILIAN. Herzog von Leuchtenberg, Beschreibung einiger neuen Thierreste der Urwelt aus den Silurischen Kalkschichten von Zarskoje-Selo. St. Petersburg, 1843, 24.
Siphonia præmorsa FERD. ROEMER. i. Leonh. u. Bronn's Jahrb. 1848, 684.
Siphonia præmorsa FERD. ROEMER. i. Lethæa geognost. ed. 3 Th. ii, 154, t. 27, f. 21. 1852–1854.
Siphonia excavata BRONN. i. Leth. geogn. ed., 3 Th. v, 75. 1851-1852.
Siphonia stipitata HISINGER. Leth. Suec. 94, t. xxvi, f. 8.
Jerea excavata D'ORBIGNY. Prodr. de Pal. strat. ii, 286. 1850.
Astylospongia præmorsa ROEMER. Die Silurische Fauna des Westlichen Tennessee, p. 8, pl. 1, figs. 1, 1a–1e. 1860.
Astylospongia præmorsa (GOLDF.) HALL. Trans. Alb. Inst., vol. iv, p. 228. Abstract, p. 34; May, 1863.

This widely distributed species which has been illustrated by Goldfuss, Hisinger, Bronn, Roemer and other authors, is a common form at Waldron, but it rarely or never attains the dimensions which it has in the same horizon in Tennessee, where it is even more common than in Indiana.

The usual dimensions of the Waldron specimens vary from ten to twenty millimetres in lateral diameter, with a vertical diameter of about one-sixth less than the lateral. There is much variation in the strength and number of the furrows and prominence of the lobes, and also in the depth and diameter of the depression at the center of the summit.

The interior structure is represented in figs. 9, 10, 11, as it appears under an ordinary lens. In all the specimens which have been cut, there is evidence of an original central cavity, filled with mineral matter which does not preserve structure.

ASTYLOSPONGIA PRÆMORSA var. NUXMOSCHATA *n. var.*

Plate 3, Figs. 12, 13.

Form, an oblate spheroid with the entire surface traversed by numerous interrupted and unequal grooves or subconfluent pits giving a rugose aspect; the sides marked by a few narrow scarcely defined sulci which do not reach the summit; summit elevated and without the central depression possessed by typical forms of the species. Entire surface covered by minute pustulose elevations which under an ordinary lens do not show structure. The minute interior structure has not been determined.

This form was included under *A. præmorsa* in the Documentary edition of this report. It is herewith separated as a variety. It occurs in association with the other forms of Petrospongia at the Waldron locality.

ASTYLOSPONGIA IMBRICATO-ARTICULATA *F. Roem.*

Siphonia imbricato-articulata FERD. ROEMER, in Leonh. und Bronn's Jahrb. 1848, 685, ix, fig. 3.

Astylospongia imbricato-articulata F. ROEM. Die Silur. Faun. des Westl. Tenn., p. 12, pl. 1, figs. 5, 5 a. 1860.

A single specimen of this species or a closely allied form, has been observed among some recent collections from Waldron.

ASTYLOSPONGIA (PALÆOMANON) BURSA.

Plate 3, Figs. 15, 16.

Astylospongia? (Palæomanon) bursa HALL. Doc. Edit. 28th Rep. St. Mus. Nat. Hist. Explanation of pl. 3, figs. 15, 16. 1876.

Compare *Palæomanon cratera* ROEMER. Die Silur. Faun. des Westl. Tenn., p. 13. pl. 1, f. 4, 4 a. 1860. Also *Aulacopina Granti* BILLINGS. Canadian Naturalist and Geologist, 1875.

Body calyciform, elongate semi-elliptical in outline, regularly rounded below and curving upwards, the sides above the middle of the height nearly straight.

Surface finely punctate and marked by elongate subconfluent pits.

The specimen figured has been laterally compressed, so that the true form would be narrower than represented in figure 15. Some specimens of recent collections with shorter and comparatively broader cups, have essentially the same general aspect of surface as this; but the large pits upon the surface are less confluent, and it is possible that these forms may be allied to *Palæomanon cratera* of Roemer, but their condition of preservation does not admit of satisfactory reference.

A single specimen with a proportionally narrower form than shown in fig. 15, presents, on a part of its surface, numerous and closely arranged stelliform spiculæ which appear to be superficial, while the surface beneath is finely punctate.

The imperfect preservation of all the larger forms of sponges in the Waldron collections is such as to render difficult and unsatisfactory any specific determinations from external form and character alone.

CORALS AND BRYOZOA.

STREPTELASMA *Hall.*

STREPTELASMA RADICANS.

Plate 5, Figs. 1-4.

Streptelasma (*Aulacophyllum ?*) *radicans* HALL. Doc. Edit. 28th Rep. St. Mus. Nat. Hist. Explanation of pl. 5, figs. 1-4. 1876.

Corallum simple turbinate, usually irregular in its growth below, or truncate, from attachment to other bodies; sometimes with radiciform extensions, often curved near the base; calyx circular, deep; dissepiments strong; a section shows twenty to twenty-two extending half-way to the center, with an equal number of short intermediate ones. A single specimen cut longitudinally shows no horizontal diaphragms, and the inner margin of the rays are crenulate.

Exterior strongly marked by the radiating ridges of the dissepiments, and usually pretty regularly enlarging from the base, though sometimes showing irregularities due to contraction and expansion of growth. Height of specimens from 25 to 40 mm.

This species is of common occurrence in the Waldron locality.

STREPTELASMA (DUNCANELLA) BOREALIS.

Plate 5, Figs. 7, 8.

Duncanella borealis NICHOLSON. Ann. and Mag. Nat. Hist., 4th series, vol. xiii. 1874.

Streptelasma minima HALL. Doc. Edit. 28th Rep. St. Mus. Nat. Hist. Explanation of pl. 5. 1876.

Corallum simple elongate-obconical; calyx deep, circular, scarcely expanding at the margins beyond the general enlargement of growth; rays, coarse and strong; epitheca strongly marked by vertical striæ indicating the rays, and usually by distinct striæ of growth which sometimes obscure

the rays; epitheca rarely covering the base, leaving the rays exsert; these, to the number of nine or ten, and sometimes twelve, coalesce in the center, gradually increasing in number with the growth of the coral till there are from seventeen to nineteen at the margin of the calyx. Length, 20 mm.

With the exception of the exsert septa at the base, this coral has all the characteristics of STREPTELASMA in the arrangement of the radiating septa which coalesce near the base and for some distance upwards, above which the lamellæ approach the center, leaving a cylindrical cavity which gradually expands above.

ZAPHRENTIS *Rafinesque.*

ZAPHRENTIS CELATOR.

Plate 5, Figs. 5, 6.

Zaphrentis? celator HALL. Doc. Edit. 28th Rep. St. Mus. Nat. Hist. Explanation of pl. 5, figs. 5, 6. 1876.

Corallum turbinate, rapidly expanding from below, with irregularities of growth, producing expansion and contraction of the cup. Calyx deep and broadly expanded, the width of the specimen figured nearly as great as the height. Dissepiments, sixty or more.

This species is of rare occurrence in the collections from the Waldron locality.

AULOPORA *Goldfuss.*

AULOPORA PRECIUS.

Plate 9, Figs. 5, 6.

Aulopora precius HALL. Doc. Edit. 28th Rep. St. Mus. Nat. Hist. Explanation of pl. 9, figs. 5, 6. 1876.

Corallum parasitic, consisting of elongate tubular cells, which in their progress of growth usually conform to the surface on which they grow, somewhat gradually enlarging to the aperture. Calyces budding laterally in a direct line or sometimes geminating and diverge at an angle of from 45 to 80 degrees. After budding, the parent cup turns upwards and ceases to grow in that direction. The corallum sometimes

spreads over a considerable extent of surface, and in other examples the calyces are crowded and grow nearly directly upwards, attaining an elevation above the attached base of three to five millimetres. In the procumbent forms the distance between the budding is about four to five millimetres, the diameter of the tube at its origin is less than one millimetre, the aperture including the exterior walls being about two millimetres.

This species bears some resemblance, in its mode of growth, to the *Aulopora Schohariæ*, but is a stouter species, except in rare examples where the tubes are more slender than in the prevailing forms.

FAVOSITES *Lamarck.*

FAVOSITES SPINIGERUS.

Plate 4, Figs. 1-5.

Favosites Niagarensis? var. *spinigera* HALL. Doc. Edit. 28th Rep. St. Mus. Nat. Hist. Explanation of pl. 4, figs. 1-5. 1876.

Favosites excretus HALL. Doc. Edit. 28th Rep. St. Mus. Nat. Hist. Explanation of pl. 9, figs. 1 and 2. 1876.

Favosites spongilla ROMINGER. Fossil Corals, page 24; reference under the head of *Favosites pyriformis*, 1876.

Form hemispheric or pyriform, often spreading and becoming lobed above. Tubes small, ranging from one to one and a half mm., the lateral walls with radiating spinulæ; diaphragms essentially flat, mural pores not determined, cell-apertures irregularly margined by spiniform processes.

This small species occurs in subhemispheric forms of from ten to twenty-five mm. in diameter and of somewhat less elevation; it also assumes pyriform shapes of similar dimensions, often becoming expanded and variously lobed above. The apertures of the cells, as usually presented, are extremely variable in size, and there is not unfrequently a group of smaller cells arranged around a larger one, and in the irregular mode of growth the margins become free and more or less curved. In rare examples the apertures are free, rounded, and a little dilated, while on the margins of the mass the tubes are subcylindrical with individual epithecæ. In such forms the apertures present an appearance as of one cell budding from the calyx of another, but this aspect is probably due to a thickening of the cell-wall or of an abrupt contraction of growth.

In specimens where the aperture is expanded, the diaphragms, visible from above, are convex with a little boss in the center.

This is undoubtedly the species indicated by Dr. Rominger as *F. spongilla*, but at the time of printing the explanations of plates for the Documentary Edition of this Report, his work had not been published.

FAVOSITES FORBESI var. OCCIDENTALIS *n. var.*

Plate 4, Figs. 6-15.

Favosites Forbesi?. Doc. Edit. 28th Rep. St. Mus. Nat. Hist. Explanation of pl. 4, figs. 6-15. 1876.
Compare *F. Forbesi* EDWARDS & HAIME. British Fossil Corals, p. 258, pl. 60.

Corallum hemispheric, subglobose or pyriform; calyces very unequal in size, the larger ones often subcircular and about three mm. in diameter, while the smallest cells are often not more than one mm. at their apertures. In rare specimens the diameter of the larger calyces does not exceed two millimetres. A vertical section shows the walls to be of medium thickness, while in the calyces they appear strong and are often crenulate from the longitudinal striæ. Mural pores, situated near the angles, in one or two ranges, depending on the size of the cell. Cell-wall granulose, the granulæ arranged in transverse lines.

The form and dimensions of the coral are fairly represented in the figures on plate 4, and few larger specimens have been observed than the one illustrated in figure 10. The species is very abundant, occurring in great numbers in the shaly limestone deposits of Waldron and vicinity. In many of the specimens the epitheca is extended from the base over the sides of the coral, covering the cell-apertures, and not unfrequently some of the larger cells upon the upper face of the coral are partially closed by an individual epithecal covering, which growing inward from the margins finally closes the aperture, after the manner of an operculum with a central node. In some examples this epithecal growth begins within the calyx walls, presenting a distinct ring with a central circular opening, giving the appearance of budding from the parent cell, but in the progress of growth the space betwen the cell-walls and the epithecal ring is closed and the central opening becomes in like manner filled.

This species has been identified with *F. Forbesi*, chiefly from its similarity with the young of that species, as represented by Edwards & Haime, *British Fossil Corals*, plate 60, though our specimens very rarely assume the form there illustrated, which is similar to one figured by Dr. F. Roemer, from the Silurian of West Tennessee. We have no specimens

presenting the characters of the older individuals represented from the Wenlock limestone, though the few larger specimens which have come under my examination do not show the great diversity in the size of the calyces which appears in the smaller corals. The position and character of the mural pores in the European species is not stated in the description. The strongly pustulose character of the cell-walls as represented in the British specimens has not been observed in the American forms.

CHÆTETES *Fischer.*

CHÆTETES CONSIMILIS.

Plate 9, Figs. 7-14.

Compare *Trematopora solida* HALL. Pal. N. Y., vol. ii, p. 153, pl. 40 A, figs. 6 *a*, 6 *b*, 6 *c*. 1852.

Chætetes? consimilis HALL. Doc. Edit. 28th Rep. St. Mus. Nat. Hist. Explanation of pl. 9, figs. 7-14. 1876.

Frond solid, ramose, frequently branching, branches in the larger specimens having a diameter of six millimetres. Cell-tubes polygonal rising from the center of the branches and gradually diverging to the surface. Cell-walls thin, strongly corrugated, transverse diaphragms extremely rare or entirely wanting. Apertures .35 mm. in diameter.

In well-preserved specimens the cell-walls at the apertures are granulose and have minute spines at the angles of the cells.

This species occurs in such forms as are figured on plate 9, presenting in the different conditions of weathering, the phases represented in the enlarged figures 8, 10, 12 and 14.

TREMATOPORA *Hall.*

TREMATOPORA OSCULUM.

Plate 10, Figs. 5-8, 11-14.

Trematopora osculum HALL. Doc. Edit. 28th Rep. St. Mus. Nat. Hist. Explanation of pl. 10, figs. 3-12 (3 and 4 in error). 1876.

Comp. *T. ostiolata* HALL. Pal. N. Y., vol. ii, p. 152, pl. 40A, figs. 5*a*-5*n*. 1852.

Frond ramose, hollow with an interior epitheca, branching infrequently; diameter of branches from one and a half to two millimetres; thickness of the substance of the bryozoum .35 mm. Cell-tubes oval; apertures .3 mm. in length, closely arranged in quincunx order, forming oblique rows, opening

upward and outward; usually the lower side of the aperture is margined by a projecting semicircular lip, which partially covers the opening; rarely the upper margin of the aperture is also elevated.

This is the most common form of the genus in the Waldron locality, and is very abundant.

TREMATOPORA INFREQUENS.

Plate 10, Fig. 3 in part, and fig. 4.

Trematopora infrequens HALL. Doc. Edit. 28th Rep. St. Mus. Nat. Hist. Explanation of pl. 10, figs. 13, 14 (in error for 3 and 4). 1876.

Frond ramose, hollow, the inner surface marked by a wrinkled epitheca; branches from one and a half to two millimetres in diameter; bryozoum about .35 mm. in thickness. Cell-tubes oval, rising obliquely from the epitheca to the exterior surface. Length of aperture about .3 mm., with the margin distinctly and equally elevated, occasionally presenting a serrated appearance; apertures separated by distances equal to their diameters, arranged in quincunx order, presenting a spiral arrangement around the branches.

This species may be distinguished from *T. osculum* by its larger cells, and by the cell-margins being strongly and equally elevated in every portion, while in that species the lower margin of the aperture is almost always more strongly elevated than the upper portion.

TREMATOPORA VARIA.

Plate 10, Figs. 15-23.

Trematopora varia HALL. Doc. Edit. 28th Rep. St. Mus. Nat. Hist. Explanation pl. 10, figs. 15-23. 1876.

Frond ramose, hollow, inner surface transversely wrinkled; branches frequent, from two to seven mm. in diameter. Bryozoum about one mm. in thickness. Cells tubular, oval or circular, from 1 to 1.5 mm. in length; for the first half of their extent growing nearly parallel with the inner surface, and then turning abruptly outward; diameter at the aperture .25 mm., varying from circular to elongate-oval, arranged irregularly from contiguity to a distance equal to the diameter, with frequent maculæ, which are destitute of cells. Cell-mar-

gins in well-preserved specimens distinctly elevated, and frequently finely serrated.

In specimens where the maculate surface is well-preserved, the adjacent cell-apertures often have their longest diameter in a radiating direction from the center of the maculæ. The cell-apertures in this species vary from circular to elongate-oval or ovate, both forms sometimes occurring on the same specimen, while in worn specimens the apertures appear to be polygonal.

TREMATOPORA ECHINATA.

Plate 11, Figs. 1-5.

Trematopora echinata HALL. Doc. Edit. 28th Rep. St. Mus. Nat. Hist. Explanation of pl. 11, figs. 1-5. 1876.

Bryozoum solid, ramose; branches from .75 to 1.5 mm. in diameter, frequently widely diverging, sometimes at an angle of 80° or 90°. Cell-tubes polygonal, generally hexagonal, commencing at the center of the branch and gradually diverging to near the surface, where they turn abruptly outward. Cell-apertures longer than wide, length from about .3 mm. to .55 mm., the width being from one-half to two-thirds their length, having at the angles of the margins slender, sharp spines.

This species is very abundant, often nearly covering the surfaces of the calcareous slabs, and imbedded in the softer shales. It presents much variation in the size of the cell-apertures, and their distribution on the surface is sometimes interrupted and irregular. The prevailing form is represented in fig. 4, plate 11. In many examples the smaller stipes and branches are marked by the larger cell-apertures.

TREMATOPORA GRANULIFERA.

Plate 11, Figs. 6, 7.

Trematopora granulifera. HALL. Pal. N. Y. vol. ii, page 154, pl. 40 A. figs. 9a, 9c. 1852.

Trematopora granulifera (n. sp. in error.) HALL. Doc. Ed., 28th Rep. St. Mus. Nat. Hist. explanation of pl. 11, figs. 6, 7. 1876.

Compare *T. regularis* HALL. 26th Rep. N. Y. St. Mus. Nat. Hist., p. 106. 1873.

Bryozoum ramose, solid; branches one millimetre or less in diameter. Cells tubular oval, rising from the center of the branch and increasing by interstitial additions. Length of

apertures .3 mm., with a width of .15 mm., arranged upon the surface in a somewhat quincunx order, being in right lines longitudinally, and in a spiral order around the stipe. Margins of apertures elevated and strongly granulose; the spaces between being flat or channeled. The borders of the apertures are sometimes coalescent, and present no intermediate groove.

TREMATOPORA MINUTA.

Plate 11, Fig. 8.

Trematopora? (Trachypora?) minuta HALL. Doc. Edit. of 28th Rep. St. Mus. Nat. Hist. Explanation of pl. 11, fig. 8. 1876.

Bryozoum ramose, very slender; branches frequent, widely diverging, diameter .5 mm. Cell-apertures elongate-oval, length about .4 mm. and width .2 mm., distance from each other longitudinally about equal to the length of an aperture, arranged in spiral rows along the branch. Margins distinctly elevated and granulose, and separated from each other by tortuous lines of nodes.

This species differs from *T. macropora** by its more elongate cell-apertures and the more prominent granulose ridges.

TREMATOPORA VARIOLATA.

Plate 11, Figs. 9, 10.

Trematopora variolata HALL. Doc. Edit. 28th Rep. St. Mus. Nat. Hist. Explanation of pl. 11, figs. 9, 10. 1876.

Bryozoum ramose, hollow, diameter of the branches from 1 to 1.5 mm. Cell-apertures oval, margins distinctly elevated, length .3 mm., width .2 mm., sometimes closely arranged, and in other cases irregularly scattered; surface with numerous maculæ which are quite destitute of cells.

This species can readily be distinguished from any other form in this association by the scattered and irregular distribution of the cell-apertures and the numerous maculæ without cells.

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* *T? macropora* HALL. *Transactions of the Albany Institute*, vol. x, p. 60.

TREMATOPORA SPICULATA.

Plate 11, Figs. 11, 12.

Trematopora spinulosa HALL. Doc. Edit. 28th Rep. St. Mus. Nat. Hist. Explanation of pl. 11, figs. 11, 12. 1876.
Trematopora spiculata HALL. Miller's Cat. Pal. Foss., p. 245. 1877.
Not *Trematopora spinulosa* HALL. Pal. N. Y. vol. ii, p. 155, pl. 40 A, figs. 11a, 11b. 1852.

Bryozoum solid, ramose ; branches frequent and not widely diverging ; diameter from 1.5 to 2 mm. Cell-tubes polygonal, arising from the center of the branch and gradually diverging till within half a millimetre of the surface when they turn abruptly outward : at the point of turning, the cell-walls, previously thin, become thickened. No transverse septa are visible till near the surface, where they are numerous and distant from each other about the width of the cell-tubes. Cell apertures variable in size, the larger ones being about .16 mm. in diameter, irregularly arranged and having short, stout spinules at the angles.

This species is readily distinguished by its solid aspect, minute cells which are variable in size, and the comparatively strong spinules which disguise the cell-apertures and give a uniform asperate aspect to the surface. Sometimes the cell-margins are worn flat and the cells appear oval. It differs from *T. echinata* in its more robust aspect, and the smaller and less elongate cells.

CALLOPORA *Hall.*

I continue the use of the name CALLOPORA, which is claimed by some authors to be identical with FISTULIPORA of McCoy, for the reason that the author of the latter genus (*British Palæozoic Fossils*, p. 11) says that " this genus was proposed to include the *Manon cribrosum* (Gold.) of the Eifel, &c., and some new species." The *Manon cribrosum* of Goldfuss is recognized by European palæontologists as a specimen of *Heliolites interstincta*. Again, in describing *F. decipiens*, the author says : " So exactly does this resemble the *Palæopora interstincta*," etc. The figures of *F. decipiens* scarcely resemble CALLOPORA in its ordinary forms. See *Descriptions of Lower Helderberg Corals and Bryozoa* for further observations on these genera.

CALLOPORA SINGULARIS.

Plate 10, Figs. 1, 2.

Callopora singularis HALL. Doc. Edit. 28th Rep. St. Mus. Nat. Hist. Explanation of pl. 10, figs. 1, 2. 1876.

Frond ramose, solid, diameter of branches two millimetres. Cells tubular, oval, or polygonal, arising from the center of the branch and gradually diverging till near the surface when they turn and open nearly directly outward. Cell-apertures .3 mm. in length, with a width of .2 mm., irregularly arranged, varying in distance from contiguity to a space equal to the length of the aperture; margins distinctly elevated, frequently crenulated by minute spinules. Intercellular spaces on the surface occupied by minute pits, which are observable only on well-preserved specimens.

Translucent sections of the stipes or branches present no evidence of intercellular vesiculose structure, and have all the aspect of a TREMATOPORA. This condition may come from a solidifying of the intercellular substance during the process of petrifaction, leaving only the intercellular pits upon the surface.

CALLOPORA ELEGANTULA.

Callopora elegantula HALL. Pal. N. Y., vol. ii, p. 144, pl. 40, figs. 1*a*–1*n*. 1852.

This species has recently been found at Waldron. It preserves the characters so well shown in the same species from the Niagara formation in New York.

CALLOPORA EXSUL.

Plate 9, Figs. 3, 4.

Alveolites exsul HALL. Doc. Edit. 28th Rep. St. Mus. Nat. Hist. Explanation of pl. 9, figs. 3, 4. 1876.

Bryozoum consisting of lamellose expansions, free or incrusting other organic bodies, celluliferous on one side; lower surface formed of a wrinkled epitheca; substance of frond sometimes very thin, and often thickened by successive accretions of growth. Cell-apertures oval, from .3 to .5 mm. in length, and usually about two-thirds as wide as long, some-

times nearly circular, closely and irregularly arranged. Intercellular space usually occupied by a single series of angular pits. Margins of cell-apertures elevated, and ornamented by from two to five short spinules. A transparent section shows an intercellular vesiculose structure, with transverse septa in the cell-tubes.

The more recent collections from Waldron contain a considerable number of specimens of this species in various conditions of preservation. The better specimens preserve the short spinules surrounding the cell apertures, with a distinct row of pits marking the intercellular space. In some of the specimens the spinulæ are more or less worn away or irregularly preserved, and in further wearing, the intercellular spaces appear as thick, solid walls separating the cell-apertures. The specimen originally figured as *Alveolites exsul* is evidently a CALLOPORA encrusting and only partially covering the surface of *Ceramopora confluens*. The illustration in figure 4 of plate 9 is incorrect in representing the cell-apertures as angular and oblique, while the cells open directly upwards; the intercellular spaces are thicker and covered with granulæ, and are formed by numerous very small angular pits or pores.

It is distinguished from a condition of *Ceramopora confluens* by the intercellular granulæ and pits.

LICHENALIA *Hall.*

LICHENALIA CONCENTRICA.

Plate 5, Figs. 9–16; Plate 6, Figs. 1, 2, 4, 7–10, and Plate 7, Figs. 3–11.

Lichenalia concentrica HALL. Pal. N. Y., vol. ii, p. 171, pl. 40E, figs. 5*a*–5*g*. 1852.

The name LICHENALIA* was originally applied by me to circular or flabelliform epithecal expansions, one side of which is concentrically wrinkled, and when in perfect condition is usually marked by fine radiating and concentric striæ, which vary in character and degree in different species. The opposite side is celluliferous. The celluliferous face is usually adherent to the stone, and the exposed surface presents the ordinary characters of the epithecal covering of a coral or bryozoum. In well-preserved examples the fine concentric and radiating striæ are apparently characteristic of the genus, and in some specimens the cell-bases are visible from the non-celluliferous face. When the exte-

* *Palæontology of New York*, vol. ii, p. 171.

rior surface is worn, it presents a grooved and striate appearance, indicating the mode of growth in the cells and cell-walls, which are usually procumbent at the commencement of their growth, and then turn upward. The celluliferous face presents numerous cell openings which may be closely or more distantly arranged, and which vary from circular to oval, and even subquadrangular in form, depending upon their mode of growth and in part upon the condition of preservation. These bodies do not always preserve the expanded form indicated, but the margins become contracted and infolded, so that the non celluliferous faces come into near contact, and assume an apparently solid form, with cell-apertures covering the entire surface. In their young state they are frequently found attached to other fossils, and this is probably the condition of all in their earlier stages of growth; the mode of growth and ultimate form being greatly dependent upon the nature of the body to which the germ has originally been affixed. In the expanded forms the cell-tubes are short, and the increase is by lateral extension of new cells, until the fronds sometimes reach a diameter of thirty centimetres. When the frond becomes corrugated or infolded in its young state, and assumes a compact form, the cell-tubes become elongated as shown in fig. 11 of plate 5, but I am unable to find that any of them assume characters incompatible with the genus in its typical forms. After examining a large number of specimens, I am unable to distinguish any characters marking a specific difference between the expanded forms, like figs. 4, 9 and 10, of plate 6, and those which assume an irregular and more solid aspect, as in figs. 9, 11 and 12, of plate 5.

LICHENALIA CONCENTRICA var. PARVULA.

Plate 7, Figs. 1, 2.

Lichenalia concentrica var. *parvula* HALL. Doc. Edit. 28th Rep. St. Mus. Nat. Hist. Explanation of pl. 7, figs. 1, 2. 1876.

This form, indicated as a variety of *L. concentrica*, is distinguished by its smaller cell-apertures, as shown in fig. 2, which is enlarged to the same degree as fig. 7. In its mode of growth and other characters it does not differ from the ordinary forms of LICHENALIA.

LICHENALIA CONCENTRICA var. MACULATA *n. var.*

Plate 6, Figs. 3, 5 and 6.

Celluliferous face, flat, concave or convex; cell-apertures round, or broadly oval, and when entire, preserving a project-

ing lip on one side; variable in their distance from each other, and sometimes quite closely arranged. Surface marked by elevated maculæ, upon which there are a few larger cell-apertures irregularly disposed, the center of the tubercle being sometimes quite free from cells.

The specimen figured has a convex exterior surface, owing to the contraction of the epitheca, and on some weathered portions, where the cell-apertures are distant, the interspaces are apparently cellulose. This feature, however, is not a prevailing one, nor has it any specific signification. In a specimen where the celluliferous face is concave, the exterior or epithecal side presents the same aspect as that of ordinary forms, and is undistinguishable from them. The maculate form of surface, or its incipient condition, is very common upon all forms of the celluliferous face of this fossil.

The variety is herewith separated from the forms figured as *L. concentrica* in the Documentary Edition of this Report.

SAGENELLA *Hall.*

SAGENELLA ELEGANS.

Plate 7, Figs. 12, 13.

Sagenella elegans HALL. Doc. Edit. 28th Rep. St. Mus. Nat. Hist. Explanation of pl. 7, figs. 12, 13. 1876.

Compare *S. membranacea* HALL. Pal. N. Y., vol. ii, p. 172, pl. 40F, figs. 6 *a*, 6 *b*.

Bryozoum a thin membraniform expansion growing upon the surface of other organic bodies. Cells subcylindrical, flattened for the greater portion of their length and continuing nearly parallel with the plane of the epitheca; arranged in a more or less diverging or radiating order, with intercalated ranges, presenting a subimbricated aspect, turning abruptly and opening upward. Cell-apertures circular, about .2 mm. in diameter.

The arrangement of cells and form of cell-apertures differ from CERAMOPORA in the rounded form and more directly upward opening. The genus differs from LICHENALIA in the more extended procumbent portion of the cell-tube, in the form of the cell-aperture, and in the much thinner and persistently adhering epitheca.

CERAMOPORA *Hall.*

CERAMOPORA LABECULA.

Plate 8, Figs. 1-3.

Ceramopora (Berenicia?) labecula HALL. Doc. Edit. 28th Rep. St. Mus. Nat. Hist. Explanation of pl. 8, figs. 1-3. 1876.
Compare *Ceramopora imbricata* HALL. Pal. N. Y., vol. ii, p. 169, pl. 40E, figs. 1*a*-1*i*. 1852.

Bryozoum growing in circular or subcircular discoid forms upon other organic bodies; greatest diameter observed about seven mm. Cell-tubes short, cylindrical, radiating from the center and increasing by lateral additions, those in the central portion being nearly vertical, and becoming more and more oblique as they recede from this point, until the marginal ones are nearly parallel with the epitheca; arranged in alternating and imbricating series. Apertures arched or somewhat triangular, .25 mm., or less, in diameter.

This species is found attached to the bases of crinoids, to gasteropods, and other fossils.

CERAMOPORA CONFLUENS.

Plate 8, Figs. 4, 5.

Ceramopora confluens HALL. Doc. Edit. 28th Rep. St. Mus. Nat. Hist. Explanation of pl. 8, figs. 4, 5. 1876.

Bryozoum, consisting of lamellose expansions growing upon the surface of other organic bodies, and attaining a thickness of from .25 to 1 mm. Cell-tubes short cylindrical, closely arranged in alternating and imbricating order. Surface often elevated in nodose prominences which are sometimes destitute of cells. Cell-apertures arching or triangular, about four in the space of one millimetre.

This species occurs in large expansions growing upon shells and upon the calyces of crinoids. The surface of the expansion rises into low rounded nodes and irregular undulating ridges, the summits of which are sometimes free from cellules, while in many examples there are a few larger cellules marking the sides of the elevation. The cell-apertures are usually closely arranged, sometimes more distant, and when entire, have the typical arching form, but where the surface is worn, they are round or broadly oval.

This species differs from *C. agellus* in not showing lines of cellules radiating from the maculæ or nodes, and in the less distinct elevation of the cell-tubes upon the surface.

Ceramopora agellus.

Plate 8, Fig. 6.

Ceramopora agellus Hall. Doc. Edit. 28th Rep. St. Mus. Nat. Hist. Explanation of pl. 8, fig. 6. 1876.

Bryozoum consisting of a thin expansion covering the surface of other organic bodies ; cells subcylindrical, short, very oblique, rapidly expanding toward the apertures. Cell-apertures, when entire, arching and angular, and when worn, broadly elliptical ; about four in the space of a millimetre on the greater part of the surface, and upon the maculæ, two or three in the same space.

The surface of the frond is marked by numerous maculæ which do not rise into nodes, but are covered by cells of from once and a half to twice the diameter of the ordinary cells. The cellules of the entire frond appear to radiate from a single point, which is not the center, and again from each of the maculæ are distinct radiating lines of cellules in the direction of the growth. In these characters the species differs from *C. confluens*. This species occurs upon the surface of Gasteropoda and Brachiopoda, but has rarely been seen upon the calyces of crinoids.

PALESCHARA *Hall.*

Paleschara offula.

Plate 8, Figs. 7, 8.

Paleschara offula Hall. Doc. Edit. 28th Rep. St. Mus. Nat. Hist. Explanation of pl. 8, figs. 7, 8. 1876.

Bryozoum consisting of a thin expansion attached to other organic bodies, one side being celluliferous ; cellules polygonal, from five to seven-sided, varying from .25 to .50 mm. in diameter.

This species presents the usual character of the species of this genus, having wide, shallow polygonal cells which are larger than those of *P. maculata*. The specimens of this species, so far as known, present no maculæ of larger cells or of barren spaces.

PALESCHARA MACULATA.

Plate 8, Figs. 9-13.

Paleschara maculata HALL. Doc. Edit. 28th Rep. St. Mus. Nat. Hist. Explanation of pl. 8, figs. 9, 10. 1876.

P.? aspera HALL. Doc. Edit. 28th Rep. St. Mus. Nat. Hist. Explanation of pl. 8, figs. 11–13. 1876.

Bryozoum a thin foliate expansion encrusting other organic bodies. Cells polygonal, contiguous, about three to four in the space of one millimetre, with maculæ of larger cells unequally distributed over the surface.

The cells appear to be arranged in somewhat concentrically radiating lines, and are longer in the direction of these lines, the length being sometimes twice as great as the width. In well-preserved specimens there are distinct short spinules at the angles of the cells.

The figures referred to *Paleschara? aspera*, on Plate 8, are representations of a phase of *P. maculata*, and the cell-apertures are incorrectly delineated.

PALESCHARA INCRASSATA *n. sp.*

Bryozoum occurring as thin, or more or less thickened, expansions encrusting other organic bodies. Cellules oval; apertures margined with coarse granulæ or spinules, and in specimens somewhat worn, the cellules are separated by a distinct intercellular space or a thickening of the cell-walls.

This form is distinguished from *P. maculata* by the smaller oval cell-apertures, the thicker interspaces and coarser granulæ at the margins of the cells. It may be only a variety of that species possessing these distinctive features.

PALESCHARA? (CHÆTETES ?) SPHÆRION.

Plate 8, Figs. 14, 15.

Paleschara? sphærion HALL. Doc. Edit. 28th Rep. St. Mus. Nat. Hist. Explanation of pl. 8, figs. 14 and 15. 1876.

Bryozoum incrusting or free, occurring in flattened, irregularly circular, or depressed hemispheric masses of one or two millimetres in thickness; in its more complete condition asuming a spheroidal hollow form. Cells polygonal, contigu-

ous, about four in the space of one millimetre, with maculæ of larger cells, the centers of which are distant from each other about four millimetres; the larger cells two or three times the size of the smaller ones.

In its mode of growth this form resembles CHÆTETES, but no specimens have been seen where the depth of the cells is more than two millimetres. The cell-apertures are somewhat more regularly hexagonal than in the preceding forms, and by this character it is readily distinguishable from *P. confluens*. This species is also distinguished from the latter by the character of the maculæ and the larger cells. In *P. maculata* the maculæ are less conspicuous, and the larger cells do not differ so much in size from the ordinary ones.

STICTOPORA *Hall.*

I continue the use of the generic term STICTOPORA for branching forms of this character, where the cell-apertures are round or oval, or sometimes partially covered by a projecting lip; and where the intervening space may be plain or marked by slender carinæ, striæ or elevations separating the rows of cells. These fossils are not properly PTILODYCTIA, as claimed by some authors, the latter being simple non-branching stipes with cells of different character from those of STICTOPORA.

STICTOPORA SIMILIS.

Plate 11, Figs. 13–16.

Stictopora similis HALL. Doc. Edit. 28th Rep. St. Mus. Nat. Hist. Explanation of pl. 11, figs. 13-16. 1876.

Compare *S. punctipora* HALL. Pal. N. Y., vol. ii, p. 157, pl. 40 B, figs. 2*a*, 2*b*, 2*c*. 1852.

Bryozoum ramose, branches flattened, width from two to three millimetres; margins destitute of cells. Cell-apertures oval, opening directly outward, closely arranged in oblique rows; length .35 mm., width .18 to .25 mm.

This species differs from *S. orbipora**, occurring in the same locality, by its thinner branches and oval cell-apertures.

* HALL, Trans. Alb. Inst., vol. x. p. 61.

FENESTELLA *Lonsdale.*

FENESTELLA AMBIGUA *n. sp.*

Plate 11, Figs. 17–21.

Hemitrypa dubia HALL. Doc. Edit. 28th Rep. St. Mus. Nat. Hist. Explanation of pl. 11, figs. 17–21. 1876.
Not *Fenestella dubia* LONSDALE.

Bryozoum broadly funnel-form; branches, eight in the space of five millimetres: on the non-poriferous side regular and somewhat rigid in appearance, flattened, striated; striæ sharp, slightly sinuous and sometimes granulose, two to three on each branch. Dissepiments strong, frequently as wide as the branches, six in the space of five millimetres, expanding at their junction with the branches and on the same plane; striated on the non-poriferous side. Fenestrules oval to subcircular, from nearly equal to twice the width of the branches, and from one-third longer to nearly twice as long as wide.

Cell-apertures in two ranges, small, circular, separated from each other by a distance greater than the aperture, four in each fenestrule, opening nearly directly upward, with a distinctly elevated margin. Ranges of cellules separated by a thin partition which extends upward to an elevation equal to twice the thickness of the branch below, and then expanding laterally on each side, forms a pseudo-branch. These pseudo-branches are connected by dissepiments which arise from the upward growth and expansion of the narrow edges of the dissepiments below, in the same manner as in the branches proper, and the surface of both the pseudo-branches and dissepiments are striated as on the non-poriferous face. In well-preserved specimens there are rows of minute pits between the striæ. This accessory surface differs, however, in some degree from the non-poriferous face proper, in the apparently more sinuous character and irregularity of growth in branches and dissepiments, giving a different aspect to the fenestrules.

FENESTELLA PARVULIPORA.

Plate 12, Figs. 1-9.

Fenestella parvulipora HALL. Doc. Edit. 28th Rep. St. Mus. Nat. Hist. Explanation of pl. 12, figs. 1-9. 1876.

Frond broadly funnel-shaped, and growing very luxuri-

antly; branches somewhat slender, from eight to ten in the space of five millimetres; bifurcations frequent and irregular. On the non-poriferous side, branches rounded, marked with fine, but distinct striæ, of which there are from five to seven on the width of the branch. Dissepiments slender, about one-third as wide as the branches, and expanding at their junction, rounded on the non-poriferous side and sharply angular or carinate on the poriferous side; five to seven in the space of five millimetres. Fenestrules subquadrangular or broadly oval, width varying from one-half to twice the width of the branches, length once and a half to twice the width. Cell-apertures in two ranges; generally four and sometimes five in the space of each fenestrule, circular or slightly oval, opening nearly directly upward; distance from each other less than the diameter of the aperture; margins distinctly elevated and slightly indenting the border of the fenestrule; space between the ranges of cellules carinated; carina sharp, elevated and nodose, the nodes in well-preserved specimens prominent, about fifteen in the space of five millimetres.

A characteristic of this species is the nodose carina, a feature not observed in any other species from this locality.

FENESTELLA ACMEA.

Plate 12, Figs. 10-14.

Fenestella acmea HALL. Doc. Edit. 28th Rep. St. Mus. Nat. Hist. Explanation of pl. 12, figs. 10-13. 1876.
Fenestella sp.? HALL. Doc. Edit. 28th Rep. St. Mus. Nat. Hist. Explanation of pl. 12, fig. 14. 1876.
Compare *F. Nervia* HALL. 26th Rep. N. Y. St. Mus. Nat. Hist., p. 93. 1874.

Bryozoum funnel-form, narrowly expanding below and spreading above, sides undulated. Branches rigid, eleven or twelve in the space of five millimetres; non-poriferous sides slightly rounded, longitudinally striated; striæ very strong and prominent, three or four in the width of the branch. Dissepiments about half the width of the branches as they appear on the non-poriferous side, about seven or eight in the space of five millimetres, expanding at their junction with the branches and transversely striated; on the poriferous side depressed and angular. Fenestrules broadly oval, a little wider than the branch, length from one and one-third to twice the width, appearing narrower and sometimes nearly obsolete on the

poriferous side. Cell-apertures small, circular, in two ranges, distant from each other more than their diameter, opening nearly directly upward; margins distinctly elevated and indenting the border of the fenestrule. Space between the ranges of cells carinate, the carina thin and elevated, abruptly expanding on each side above, and again narrowing to a thin carina.

The elevated and expanded carina which is again carinate, and the partial closing of the fenestrules on the poriferous side are characteristics of this species.

The specimen, *Fenestella sp?* fig. 14, ut cit., proves to be identical with undoubted *Fenestella acmea*, and differs from *F. bellastriata* n. sp. in its regular oval fenestrules, having a length never greater than twice the width, and eight to nine fenestrules in the space of 5 mm. In *F. bellastriata* there are six fenestrules in the space of 5 mm., and they have always a length greater than twice the width.

A small fragment of the poriferous side of the specimen figured presents the character of *F. acmea.*

FENESTELLA PUNCTOSTRIATA.

Plate 12, Figs. 15, 16.

Fenestella punctostriata HALL. Doc. Edit. 28th Rep. St. Mus. Nat. Hist. Explanation of pl. 12, figs. 15, 16. 1876.

Frond flabelliform, branches strong, six in the space of 5 mm.; on non-poriferous side rounded, striated; striæ very distinct, five to ten on each branch, finely granulose. Dissepiments variable, sometimes slender, often thickened, and the branches sometimes anastomosing from lateral contact. Fenestrules variable in shape, width about the same as the branches, length from three to five times their width. Cell-pores in from three to five ranges, five or six pores in the length of a fenestrule. Apertures polygonal, contiguous and alternating, forming oblique rows across the branch; partitions thin, sharp and slightly granulose.

The poriferous side of the frond of this species was unknown at the time of giving the illustrations on plate 12. The study of many specimens shows that there is considerable variation in the fenestrules, which is not indicated in fig. 15. The striato-punctate character of the non-poriferous side, and the poriferous side with large angular cellules in more than two rows, are distinguishing features of the species.

THAMNISCUS *King.*

THAMNISCUS NIAGARENSIS.

Plate 11, Figs. 22-25.

Thamniscus ? Niagarensis HALL. Doc. Edit. 28th Rep. St. Mus. Nat. Hist. Explanation of pl. 11, figs. 22-25. 1876.

Bryozoum fruticose, often somewhat broadly funnel-shaped, numerous stems growing from a common base, bifurcating but not uniting laterally ; branches much thickened below the bifurcations ; celluliferous on the exterior side ; non-celluliferous side striated ; striæ strong, sinuous, often granulose, from three to five in the width of the branch ; poriferous side frequently angular in the middle ; cell-apertures contiguous, round, or polygonal from contact of the margins with each other, irregularly arranged, from .15 to .25 mm. in diameter.

This species occurs as a ramose frond rising from a single base, or spreading equally on all sides and broadly funnel-shaped. The poriferous sides of the branches are round or angular. No other species of the genus is known to me in the Niagara formation.

CRINOIDEA.

SACCOCRINUS *Hall.*

SACCOCRINUS CHRISTYI *Hall.*

Plate 13, Figs. 12-20.

Actinocrinus Christyi HALL. Trans. Alb. Inst., vol. iv, p. 196. Abstract, p. 2; May, 1863.

Not *Actinocrinus Christyi* SHUMARD. 1st and 2d Rep. Geol. Surv. Miss., pt. ii, p. 191, pl. A, fig. 3. 1855.

Actinocrinus Whitfieldi HALL. 20th Rep. N. Y. St. Cab. Nat. Hist., p. 326; Doc. Edit., 1868.

Actinocrinus (Saccocrinus) Whitfieldi HALL. 20th Rep. N. Y. St. Cab. Nat. Hist., pp. 370, 430; Revised Edit. [1870.]

Saccocrinus Christyi (HALL) M. & W. Geol. Rep. Ill., vol. iii, p. 347, pl. 5, fig. 1. 1868.

Megistocrinus Marcouanus W. & M. Mem. Bost. Soc. Nat. Hist., vol. i, p. 87, pl. 2, fig. 5. 1866.

Megistocrinus infelix W. & M. Mem. Bost. Soc. Nat. Hist., vol. i, p. 110, pl. 11, fig. 7. 1866.

Body below the arms elongate, urn-shaped, or subovate, very slightly spreading at the arm-bases. Basal plates proportionally small, more abruptly spreading than the succeeding plates, their lower margins somewhat produced near their junction with the column. First radial plates of moderate size, height and width equal, those of the postero-lateral rays smaller; second radial plates hexagonal, somewhat wider than high; third radials heptagonal, higher than wide, smaller than the second, supporting a pair of supraradials on each upper sloping side, one above the other, the upper one a bifurcating plate, and supporting a series of brachial plates on each upper side, giving four arms to each ray. Interradial plates numerous, the first one hexagonal, intermediate in size between the first and second radials, supporting two in the second and third ranges; about five other ranges above, of two or three plates each, gradually decreasing in size toward the summit. First anal plate heptagonal, equal in size to the largest first radial, but shorter, and supporting three smaller

plates in the second range with a large number of smaller plates above. Intersupraradial spaces occupied by from five to seven plates each, which gradually decrease in size from below. The summit, in older specimens, is depressed convex, composed of a large number of polygonal plates, having near the anal side an aperture (or proboscis?) which is surrounded by smaller plates. The plates of the radial series are marked along their centers by an elevated ridge, which is interrupted at the sutures of the first, second, and third radials, being a simple elongate node on the first radial, becoming more distinct in the supraradial series, and strongly elevated on the brachials; bifurcating on the fourth plate and again on the second above, with two or three plates of the brachial series above these, before the separation of the arms from the body.

Surface, in well-preserved specimens of the plates, toward their margins (except the horizontal faces of the direct radial series), marked by fine, sharply elevated radiating striæ, which cross the suture line uniting with similar ones on the adjacent plate; there are, likewise, sometimes, short ridges, or elongate nodes, radiating from near the margins of the interradial plates and uniting with similar ones on the adjacent plates. All the plates are marked by a finely granulose surface, the granulæ being arranged in concentric lines parallel to the margin of the plates. Column enlarging just before reaching the base of the cup, composed of very thin discs, which are coarsely granulose on their margins.

This species has some resemblance to *Actinocrinus* (*Saccocrinus*) *speciosus* (Pal. N. Y., vol. ii., p. 205, pl. 46, fig. 1), but differs in the proportional size and form of the plates, in the ridges of the radial series, and the bifurcation of the arms previous to their separation from the body.

MACROSTYLOCRINUS *Hall.*

In the second volume of the Palæontology of New York, published in 1852, I proposed the name MACROSTYLOCRINUS for a crinoid having three basal plates, and five rays of three plates each, from which proceed the arms; the interradial series consisting of about five plates. In 1860, Dr. F. Roemer

proposed CYTOCRINUS* for a crinoid of precisely the same structure and of similar form. The latter, though published eight years later, has the advantage of being a more euphonious name.

The genus CTENOCRINUS of Bronn, as described by Pictet, possesses a structure resembling, or identical with, CYTOCRINUS and MACROSTYLOCRINUS, though the exterior character is very distinctive; for the present I retain the latter name.

MACROSTYLOCRINUS STRIATUS.

Plate 13, Figs. 1–4.

Macrostylocrinus striatus HALL. Trans. Alb. Inst., vol. iv, p. 207. Abstract, p. 13; May, 1863.

Body depressed turbinate: calyx to the summit of the first radials hemispheric in form. Rays from the second radials spreading; interradial spaces depressed or not expanding beyond the upper edge of the first radial plate; basal plates comparatively large; first radials large, prominent in the middle near the upper margins; second radials hexagonal, not half as large as the first, wider than high; third radials smaller than the second, pentagonal, wider than high, supporting arm plates on the upper sloping sides; first interradials larger than the second radials, hexagonal, supporting two plates in the second range.

Surface finely and beautifully striated by fine, sharp, undulating striæ, about twelve of which traverse the lower side of the first radial plate, meeting similar ones from the basal plates; the apices or junction of the striæ are in the line from the center to the angles of the plates in the basal, first radial and interradial plates, while on the surface of the smaller plates these lines are sometimes broken into granules.

This species resembles the *M. ornatus* from the shale of the Niagara group at Lockport, N. Y.; but the rays are more spreading and the surface markings are finer.

MACROSTYLOCRINUS STRIATUS var. GRANULOSUS *n. var.*

Among the collections from Waldron there is another species of this genus, or a constant variety, which presents a uniformly finely granulose surface. The prominent short ridge from the

* *Silurische Fauna des Westlichen Tennessee*, p. 4, Tab. 4, figs. 2 a, 2 b, and 2 c.

first radial which supports the arm is not so marked and is more angular. There is likewise a slight angularity of the body at the base of the radial plates, and the base of the calyx at its junction with the column is trilobate. The arms are long and slender and are not observed to bifurcate above the summit of the calyx. In a specimen having a height of calyx of 5 mm. the length of the arms is 21 mm.

MACROSTYLOCRINUS FASCIATUS.

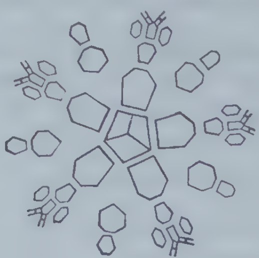
Plate 13, Figs. 5, 6.

Cyathocrinus fasciatus HALL. Doc. Edit. 28th Rep. St. Mus. Nat. Hist. Explanation of pl. 13, figs. 5, 6. 1876.

Body rotund, calyx symmetrically cup-shaped ; basal plates apparently three (not satisfactorily determined) closely anchylosed, and supporting five hexagonal first radial plates ; upper side of the first radial shortly truncated and supporting a small second radial, which in direct line supports a smaller one, from the upper sloping sides of which proceed two small arms. The first radial plates, on their adjacent sloping faces, support a heptagonal interradial plate, above and adjacent to which are three other interradials not fully determined.

Surface granulose-striate, the striæ sometimes in strong fascicles, to the almost entire exclusion of granulæ. Fascicles of striæ radiating from the basal plates to the margins of the plates above and uniting in a prominent stellate arrangement on the centers of the first radial plates. From the center of the first radial plates upward proceeds a distinct rounded ridge which extends to the third radial where it bifurcates to the arm plates.

Height of body to bifurcation of the arms 9–11 mm. Diameter of cup 7–8 mm. Column at base 1.5 mm.



The structure of the body above the base is that of the simplest form of ACTINOCRINUS, but without any distinctive

feature of an anal side. The surface markings are characteristic of the species, and in some specimens the fasciculate striæ are raised into strong ridges of a more prominent character than those represented in the figure. In a single specimen observed the striæ are subdued and separated, with the interspaces marked by fine granulæ. The preceding diagram illustrates the structure so far as it has been observed.

Observations upon the genera GLYPTOCRINUS, GLYPTASTER, BALANOCRINUS *and* LAMPTEROCRINUS.

In the first volume of the *Palæontology of New York*, I proposed the genus GLYPTOCRINUS for a lower Silurian form, common in the blue shaly limestone of the Hudson River group at Cincinnati and elsewhere in the west. This genus is characterized by the presence of five basal or subradial plates, succeeded by five series of radial plates of three each, below the first subdivision of the ray. The column at its junction with the body is pentalobate. The genus has been recognized and several other species described by different authors. A careful examination of the basal cavity of some of the specimens gives indication that the last joint of the column may be divided, representing five undeveloped basal plates.

In the genus GLYPTASTER, five basal plates and five subradials are distinguished, with the rays consisting of three plates each, below the first subdivision.

The distinction between these genera is, therefore, as follows: In the first, the non-development of true basal plates, while the ray is twice subdivided before becoming free; and in the typical species the arms are not again subdivided. In the second, a moderate development of the true basal plates, with subradials above, while the ray is but once subdivided before becoming free.*

At the time of proposing the genus GLYPTASTER, I was not acquainted with the structure of BALANOCRINUS of Troost. The latter genus I recognized in the Wisconsin Report of 1860. Upon further examination, it appears that BALANOCRINUS of Troost has the structure of GLYPTASTER, with this exception, that the basal plates are much more fully developed, while the rays do not bifurcate before becoming free. Notwithstanding, therefore, the great similarity and near identity of structure in these forms, there seems good reason for the generic separation.

The genus LAMPTEROCRINUS of Roemer is identical with

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* See illustrations of structure, on pp. 206, 207, *24th Report on the State Museum of Natural History*. 1872.

the genus BALANOCRINUS of Troost. The latter name was first published in Troost's Catalogue in 1849. The name LAMPTEROCRINUS was published in 1860, and in that year I recognized the genus BALANOCRINUS and described a species (*B. inflatus*) from the Niagara group of Wisconsin.*

The group of species referable to these genera is a very interesting one, and the following contribute some further information in relation to their geological distribution.

GLYPTOCRINUS *Hall.*

GLYPTOCRINUS CARLEYI.

Plate 14, Figs. 7-10.

Glyptocrinus Carleyi HALL. Trans. Alb. Inst., vol. iv, p. 203. Abstract, p. 9; May, 1863.

General form of body pentangularly turbinate, having the angles coincident with the rays and marked by a rounded ridge, the intermediate spaces concave. The upper disc of the column is marked by five divisions indicating the undeveloped basal plates; subradial plates (basal plates of the generic description), wider than high, each one marked by a single or double rounded radiating ridge. Radial series strongly marked by a longitudinal rounded ridge, which bifurcates with the first and second division of the ray, giving from four to eight arms to each ray as it leaves the body. Besides the longitudinal ridge, the plates of the radial, interradial and supraradial series are marked by sharp radiating ridges, with the intermediate spaces finely granulose. Rays bifurcating on the third or fourth plate, and again on the second or third above, and on the sixth or seventh of the supraradial series. Interradial plates, eight or more (probably ten or twelve), with many small intersupraradials.

Summit flat, depressed convex, or slightly concave, finely pustulose, composed of numerous small plates. Proboscis(?) small, subcentral.

In form this species resembles the *G. decadactylus* of the Lower Silurian strata, but is proportionally shorter and a little more rapidly expanding. The radiating ridges upon the plates are thinner and sharper, and the intermediate spaces more strongly granulose. The column and arms are unknown.

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*Published in the *Report of Progress of the Geological Survey of Wisconsin*. 1861.

GLYPTASTER *Hall.*

GLYPTASTER OCCIDENTALIS.

Plate 13, Figs. 7-11.

Glyptaster occidentalis HALL. Trans. Alb. Inst., vol. iv, p. 204. Abstract p. 10; May, 1863.

Body of medium size, broadly subturbinate; basal plates small, distinctly developed; subradial plates comparatively large, marked by a single rounded ridge which bifurcates in the middle of the plate, the divisions passing to the sutures of the radial plates. First radial plate large, the lower half marked by two rounded ridges which are continued from the two adjacent subradials, and unite on the middle of this plate, continuing along the second and third radials, and bifurcating on the latter, following the subdivisions of the ray. Interradials about three, with one interradial space (the anal) larger and containing a greater number of plates.

Surface of the ridge on the subradial and radial plates, marked by longitudinal striæ, while all the plates are marked by sharp radiating lines, which are continuous or interrupted and granulose, the granules being often arranged in more or less confluent lines; intermediate surface of plates granulose.

Column round above; arms unknown.

GLYPTASTER OCCIDENTALIS var. CREBESCENS *n. var.*

A specimen of somewhat more robust character than those described, has the ridges of the rays marked with undulating, subgranulose striæ, and the plates more distinctly striate, while the anal area is large and subventricose, showing three ranges of plates in the order of one, three and four, with a more numerous fourth range. The anterior ray gives some evidence of a second bifurcation before becoming free from the body.

Having but a single specimen of this character, I hesitate at present to designate it as a distinct species.

GLYPTASTER INORNATUS.

Plate 14, Figs. 1-6.

Glyptaster inornatus HALL, Trans. Alb. Inst., vol. iv, p. 205. Abstract p. 11; May, 1863.

Body somewhat urn-shaped, abruptly spreading at the base with the sides somewhat straight or moderately expanding; pentangular, the angles corresponding to the rays, and becoming ten-angled above the division of the rays. Basal plates much developed, distinctly pentangular, with the lower margins expanded and thickened, with a double or triple node on each one, and spreading beyond the column. Subradials large, six-sided except the one on the anal side which is seven-sided. First radials about equal in size to the subradials, heptagonal (as usual in the genus); second radials much smaller, quadrangular, and pentangular in the postero-lateral rays; third radials a little larger than the second, heptagonal. Supraradial series consisting of four or more plates before reaching the free arms, with an intersupraradial space which is occupied by five or more plates. First interradial plate octagonal, but little smaller than the first radial, and supporting two smaller plates in the second range, three in the third range, and several smaller plates above. On the anal side the first plate is octagonal, as large or larger than the first interradial plate, and resting on the heptagonal subradial plate, supporting four plates in the second range, with ten or twelve plates irregularly disposed above.

The subradial plates are prominent in the middle, with low undefined angular ridges extending to the sides of the plates, the intermediate spaces depressed. The ridges from the center to the upper sides of the plates are a little more prominent, and meet at the sutures with similar ridges on the lower sides of the first radials; these uniting on the center are continued in a stronger ridge along the center and following the subdivision become more prominent on the supraradial plates. The faces of the radial plates are marked by similar but less defined elevations extending to the sutures, and meeting similar ridges on the interradial plates. There are rarely some intermediate folds or undefined ridges upon the surface of the plates.

The surface has no peculiar markings. The column in its upper part is cylindrical, composed of unequal joints, which often appear to be made up of unequal or irregular plates.

This species differs from *G. occidentalis* and from *G. brachiatus* (*Pal. N. Y.*, vol. 2, p. 197) in the absence of surface sculpturing, nodes, or granules; in the greater development of basal plates, and the quadrangular form of the second radials.

CYATHOCRINUS *Miller*.

CYATHOCRINUS POLYXO.

Plate 15, Figs. 10-17.

Cyathocrinus Polyxo HALL. Trans. Alb. Inst., vol. iv, p. 199. Abstract p. 5; May, 1863.

Body broadly turbinate, base large and somewhat protuberant, sides angular from the prominence of the centers of the subradial and radial plates. Basal plates wider than high, the basal margins expanded at the junction with the column. Subradials large, wider than high; radials large, hexagonal, much wider than high, deeply notched on the upper margin; the articular scar is comparatively small and indenting the plate to about one-fourth of its depth. First anal plate quadrangular, nearly equal sided, resting upon two subradials, and supporting on one of its upper sides one end of the adjacent radial plate; second anal plate larger than the subradials, resting upon one subradial and the first anal, and between the radial plates of the adjacent rays.

The subradials, first radials and anal plates are prominent in the center, with low angular ridges extending to the sutures, the intermediate spaces being depressed, giving a strongly angular appearance to the cup. Entire surface smooth or very finely granulose. Summit, arms, and column unknown.

The body of this species is usually somewhat unsymmetrical from the anal side being more elongated or higher, and less ventricose than the other sides. The very large second anal plate, the protuberant base and large cicatrice for the column attachment, are distinguishing features of the calyx.

CYATHOCRINUS NUCLEUS.

Plate 15, Figs. 7–9.

Dendrocrinus nucleus HALL. Doc. Edit. 28th Rep. St. Mus. Nat. Hist. Explanation of pl. 15, figs. 7–9. 1876.

Body of medium size, depressed-turbinate, width one-fourth to one-third greater than the height, pentalobate in the upper part. Basal plates short, truncated below by the large column; subradial plates wider than high, three of them pentagonal and two heptagonal. First radial plates large, gibbous and projecting laterally so as to give a distinctly pentalobate aspect to the fossil; second radials much smaller than the first, wider than high, and separated by a small intercalated plate which rests upon the short sloping upper lateral faces of the first radials; third radials subpentagonal and supporting an arm upon each upper sloping face; arms (in part) bifurcating on the third plate, and above the last radial; anal plates two. Surface finely and strongly granulose.

The specimens before me vary from a height of 8 to 11.5 mm. with a diameter of 10 to 15 mm. The base of the column in the smallest measures 3.5 mm. and of the largest 5 mm. The column is proportionally very large and firmly inserted at the base, the upper plates are comparatively thin, and below these are alternations of thicker and thinner plates.

The figures given on plate 15 are from a young specimen, and do not fairly represent the species. The cicatrices on the radial plates are too narrow, and incorrectly represented as arm-bases. The species is not a DENDROCRINUS, but a true CYATHOCRINUS in structure.

LECANOCRINUS *Hall.*

LECANOCRINUS PUSILLUS.

Plate 15, Figs. 1–6.

Cyathocrinus pusillus HALL. Trans. Alb. Inst., vol. iv, p. 200. Abstract p. 6; May, 1863.

C. pusillus HALL. 20th Rep. State Cab. Nat. Hist. p. 324; Rev. Edit. p. 366.

C. pusillus HALL. Doc. Edit. 28th Rep. St. Mus. Nat. Hist. Explanation of pl. 15. 1876.

Calyx small, forming a broad shallow cup a little inflated on the anal side. Basal plates very small, covered for nearly

one-half their length by the column. Subradials proportionally large, three hexagonal and two larger and heptagonal. First radials short, broad, pentangular, the width twice the height: the second radial is a short plate having a width five times as great as the height, curving gently downward in the middle, and succeeded by a short pentangular plate supporting on its upper sloping sides a series of short linear arm plates; in some of the rays there is a second subdivision on the fourth plate above. First anal plate quadrangular, a little longer than wide, resting obliquely upon the two heptagonal subradials, and supporting upon its upper side one end of the adjoining first radial plate; the second anal plate, which is larger than the first, hexagonal, resting upon the top of a subradial and against the upper end of the first anal, supported on the sides by the first radial plates of the postero-lateral rays. Column small, round at its junction with the body. Entire surface finely granulose.

This species was originally described from the calyx, including the first radials, and its relations to LECANOCRINUS were not fully apparent. A more extensive collection from the locality has brought a considerable number of specimens in the same state as the one figured, including a single individual retaining the arms. In this condition its relations with the above genus are very apparent. The base is more spreading and more symmetrical than in the New York species of the genus, and the subdivision of the arms is likewise different. The form of the calyx corresponds to *Poteriocrinus pisiformis* of Roemer, from the Niagara formation of Tennessee, but in the figure of that species there is no indication of an anal plate corresponding to the first anal plate of this fossil, though the figure is otherwise very similar.

ICHTHYOCRINUS *Conrad.*

ICHTHYOCRINUS SUBANGULARIS.

Plate 16, Figs. 11–13.

Ichthyocrinus subangularis HALL. Trans. Alb. Inst., vol. iv, p. 201. Abstract, p. 7; May, 1863.

I. subangularis HALL. 20th Rep. St. Cab. Nat. Hist., p. 325, pl. 11, figs. 15, 16; pp. 867, 429, of Revised Edit. [1870.]

I. corbis W. & M. Mem. Bost. Soc. Nat. Hist., vol. i, p. 89. 1865.

Body elongate, narrowly turbinate or obconic below, becom-

ing cylindrical above, angular above the base by the prominence of the radial series; base truncate for the articulation of the rather large column. Basal plates rudimentary, concealed by the column. Subradial plates appearing pentangular from their junction with the column, somewhat higher than wide. The primary radial series consists of three plates each; the first one pentangular, with the upper angles slightly truncated; the second quadrangular; the third pentangular, supporting on its upper sides the first plates of the second radial series. The second radial series consists of ten ranges of rectangular plates, four to five in each range. The third radial series is composed of twenty ranges of narrow rectangular plates, seven to twelve in each range. The fourth radial series consists of forty ranges of similar plates, the number not having been observed; but no evidence of free arms is shown up to the eighth plate of the fourth series. No interradial plates have been observed. The plates are all emarginate at the center of the upper margins and correspondingly produced on the lower side, except the upper plate of each range which is produced at both margins.

Surface of the radial plates elevated in the center; entirely smooth.

This character of the species, in the emargination of its plates, corresponds with that of the small patelloid plates of FORBESIOCRINUS, and in most respects it resembles that genus, except in the absence of interradial plates. This species differs from any other of the genus before described, in the narrowly turbinate form of the cup, the subangular outline of the basal portion, and the elongate cylindrical form of the upper part.

MELOCRINUS *Goldfuss.*

MELOCRINUS OBCONICUS.

Plate 14, Figs. 11-14.

Melocrinus obconicus HALL. Trans. Alb. Inst., vol. iv, p. 206. Abstract, p. 12; May, 1863.

Body narrowly subturbinate or obconical; basal plates forming together an elongate quadrangular prominence which scarcely expands above, and from which the body gradually

enlarges to the base of the arms. Radial series of three plates each, the first of these heptagonal, and the largest plates in the body; second radials a little smaller than the first, octagonal; third radials much smaller, heptagonal, and supporting on each upper sloping side a series of two supraradials, the upper one apparently a bifurcating plate in some of the rays.

The interradial series, in three of the areas, are one, one, and two or three, and in the other two areas one, two and three or four. The summit is pentalobate, covered by small plates, and showing the base of a slightly excentric proboscis. The plates of the body are smooth in the middle, with short, abrupt, angular ridges near the margin, which meet similar ridges of the adjoining plates at the suture lines.

Height from the base to the summit but little more than half an inch, and greatest width at the arm bases about the same.

The genus TURBINOCRINUS of Troost differs from MELOCRINUS in having the first plate of one of the interradial spaces (or the first anal plate) truncating one of the basal plates, which does not occur in any known species of MELOCRINUS. The structure of TURBINOCRINUS above the basal plates is similar to ACTINOCRINUS, differing from that genus only in the presence of four basal plates.

RHODOCRINUS *Miller*.

Subgenus LYRIOCRINUS *Hall*.

RHODOCRINUS (LYRIOCRINUS) MELISSA.

Plate 15, Figs. 18–27.

Rhodocrinus Melissa HALL. Trans. Alb. Inst., vol. iv, p. 198. Abstract, p. 4; May, 1863.

Body depressed subspherical, or nearly hemispheric; base nearly flat or very depressed convex; central column cavity abruptly and deeply depressed; sides inflated in the lower part and contracted just below the arm-bases, where it is again a little expanded. Basal plates very small, concealed within the cavity and covered by the column. Subradial plates elon-

gate heptagonal, their greatest width about one-third above their lower margin. Radial plates proportionally large; the first pentangular, wedge-form below; the second hexagonal, as large as the others; the third usually hexagonal (sometimes pentagonal), supporting on the upper sloping faces one or two large supraradial plates, with a very small bifurcating or axillary plate resting in an excavation in the middle of the upper margin of the second, above which commence the arm plates; resting partly on this small plate, and partly on the second supraradial plate above the third radial, and, upon the upper margin of the latter, there is a somewhat large, heptagonal, intersupraradial plate.

The interradial and anal series consist of four plates each; the first heptagonal, as large as the radials or larger, supporting two somewhat smaller hexagonal plates in the second range, one still smaller in the third, above which the brachial plates of the adjacent rays unite; the anal series is the same as the interradial in the best formed specimens; but there is sometimes a slight irregularity seen in one series, which we infer may be the anal side. Surface of plates flat or with only the general convexity of the body, covered by very fine confluent granules or interrupted radiating striæ, which unite at the sutures; each subradial plate is marked at the middle of the lower margin with a small triangular node and a somewhat elevated rim, giving a pentalobate border to the basal cavity. In many specimens the first radial plate is marked by a central node.

Summit nearly flat and depressed towards the margins or to the inner side of the arm-bases, composed of numerous small polygonal plates, with a subcentral proboscis, and on the inner side of each pair of arms a foramen opening into the cavity of the body. Plates of the dome irregular in size and varying in different individuals, the specimen figured having larger plates than some others which have been subsequently observed.

Arms two from each ray, each one composed of short, wide pentagonal plates which are interlocking at their adjacent edges; plates gradually becoming shorter and the arms gradually tapering to their extremities. Length of arms about 65 mm., lateral diameter at the base 8 mm. Column round, not enlarging at its junction with the body, and uniformly cylin-

drical for some distance below; composed of thin plates, each fourth plate being thicker and armed with a row of strong nodes.

In general form and the symmetrical arrangement of plates, this species has much the appearance of EUCALYPTOCRINUS; but the subradial plates and greater number of interradials, and the absence of the elongate plates separating the pairs of arms as in that genus, are distinguishing characters. In the flatness of the plates, their peculiar surface markings, and their arrangement, this species differs from all others of the genus RHODOCRINUS described.

The relation of this species to *Lyriocrinus* [*Rhodocrinus*] *dactylus* of the Niagara formation in New York (Pal. N. Y., vol. ii, p. 197, plate 44) is very obvious, though there are differences which make it desirable to continue the specific distinction.

The difference between the species here noticed and the typical forms of RHODOCRINUS seem to me to warrant the continued use of the designation LYRIOCRINUS, at least as a subgeneric term.

EUCALYPTOCRINUS *Goldfuss.*

EUCALYPTOCRINUS CRASSUS.

Plate 17, Figs. 1-11; Pl. 18, Figs. 1-9; Plate 19, Figs. 2, 4, 5.

Eucalyptocrinus crassus HALL. Trans. Alb. Inst., vol. iv, p. 197. Abstract, p. 3; May, 1863.

E. crassus HALL. 20th Rep. St. Cab. Nat. Hist., p. 323, pl. 11, figs. 2, 3. Rev. Edit., p. 365.

Body massive, turbinate from the base to the arms, and with the interbrachial plates and arms attached, it has a general subovate form with a truncate base, which in most specimens is deeply impressed at the column attachment. Basal plates small, concealed in the basal cavity. First radial plates much larger than the succeeding ones, height and width subequal; second radials quadrangular, length and breadth equal, the greatest width at the base; third radials hexagonal, the lower lateral and upper sides shorter than the other three. First supraradials somewhat smaller than the third radials, pentangular in well formed specimens; second supraradials less than half as large as the first, pentangular, supporting on

each upper sloping side a small triangular plate, upon which rest the first arm plates. The interradial plates are one large and two smaller to each field ; the large one is ten-sided and elongate-ovate, its greatest width above the middle ; the others are nearly as long but narrow, united at their margins the entire length, greatest width below the middle, the summits reaching as high as the fourth or fifth pair of arm plates. The intersupraradial plate is single, having the form of the two upper interradials when united, but smaller.

This species is extremely variable in form and proportions of the body, the older specimens being often more elongate, and sometimes constricted near the middle of the cup, giving a concavity to the sides. The base is much broader in some specimens, giving to the first radials a greater proportional breath. It differs from the *E. lævis* and *E. Phillipsi* of Troost, in the much greater height of cup, greater elongation of plates, and in having a less proportion of the first radial plates within the basal cavity.

A measurement of the calyx in some of the larger specimens gives a height of 50 mm., with a diameter across the top of 60 mm., and across the base of 27 mm. One specimen having a height of 50 mm., has a diameter at the base of 23 mm. One individual of more cylindrical form than usual has a height of 30 mm. with a diameter of the calyx at the summit of 28 mm. and a basal diameter of 16 mm. The figures 6, 7 and 8 of plate 17, and figures 1, 2, 4 and 6 of plate 18 are good illustrations of the prevailing forms of this abundant species.

EUCALYPTOCRINUS CÆLATUS.

Plate 16, Figs. 1-10; Plate 19, Figs. 1, 3.

Eucalyptocrinus cœlatus HALL. Pal. N. Y., vol. ii, p. 210, pl. 47, figs. 4a-4e. 1852.
E. cœlatus HALL. Trans. Alb. Inst., vol. iv, p. 226. Abstract, p. 32; May, 1863.
E. cœlatus HALL. 20th Rep. St. Cab. Nat. Hist., pp. 321, 329. Rev. Edit., pp. 363, 366.

Body ovoid ; base somewhat broadly truncate, and concave for the attachment of the column ; calyx broadly cyathiform, shallow, height equal to one-third of the entire height of the body. Basal plates concealed in the cavity and covered by the summit of the column. Subradial plates strong, gently incurved at their basal margins which are covered by the column, thence expanding outward they are recurved above the middle, leaving the basal margins but little below the plane of the upper margins of the same plates. Second radial

plates quadrangular, wider than high; third radials pentagonal, wider than high, and with the large ten-sided interradial plate, giving great expansion to the upper part of the calyx. Arm plates narrow in the lower part, but becoming gradually wider above, giving an elongate elliptical area between the solid interbrachial plates. Summit flat, depressed, convex or slightly concave.

Column round, and near the summit composed of strong thick plates, with the margins projecting and rounded. Surface ornamentation always conspicuous and characteristic though subject to considerable variation. The plates of the body are covered with round, angular, or elongated nodes, and sometimes with straight or tortuous ridges often arranged in lines somewhat parallel to the margins of the plates. The younger specimens are much more strongly nodose than the older. The arms are usually marked by two parallel ranges of rounded nodes along the central part, while there is a range of smaller nodes on the exterior margins. These nodes are sometimes confluent, and appear as transverse ridges. The interbrachial plates are marked by two ranges of rounded or transversely elongated nodes.

Figures 4 and 8 of plate 16 exhibit the base and upper margins of a large individual. The largest specimen of the calyx observed has a diameter of 50 mm. with a height of 25 mm.

The distinguishing features of this species, as it occurs in the Waldron collections, are the general rotund ovoid form, broad spreading calyx, with about one-third the height of the first radials covered by the column; the arms stout and each pair in length about three to three and a half times their greatest width.

For diagram of structure of *E. cælatus* see *20th Report on the State Cabinet of Natural History*, page 321; Revised edition, page 363.

EUCALYPTOCRINUS OVALIS *Troost.*

Plate 17, Figs. 12, 13.

Eucalyptocrinus ovalis TROOST. Catalogue of Crinoidea. 1849.

Eucalyptocrinus ovatus (in error for *E. ovalis*). Doc. Edit. 28th Rep. St. Mus. Nat. Hist. Explanation of pl. 17, figs. 12, 13. 1876.

Body oval-ovoid, outline curved from base to summit; the calyx somewhat deeply cup-shaped, and having a height

equal to two-thirds the height from the base of the arms to the summit. Basal plates covered by the column. First radial plates strong, the greater portion of their height visible exterior to the column; second and third radials wider than high. Arms attaining their full width near the base, and continuing of the same width to about the middle of their length, and thence gradually tapering to the summit. The solid interbrachial plates narrow in the lower and middle part, and greatly expanded at the summit.

Column strong, composed of thick joints with rounded margins, alternating with an equal number of much thinner joints with flattened edges.

I have identified this species with the *E. ovalis* of Troost, from a comparison of the original specimens, which in the better preserved individuals have the same form and proportions. It differs from the young of *E. crassus* in the regularly elliptical outline of the entire body, the curving of the sides of the calyx, the less incurvation of the first radial plates into the column cavity, which is proportionally smaller than in that species. It is also especially distinguished from both *E. cœlatus* and *E. crassus*, by the great expansion of the interbrachial plates upon the summit, if such features are to be regarded as of specific value.

Compare fig. 13 of plate 17, with figs. 5 and 7 of plate 16, and with figs. 5 and 7 of plate 18.

Roots of EUCALYPTOCRINUS.

Plate 19, Figs. 6–8; and Plate 20.

The condition of the ancient ocean bed in the region of country now occupied by central Indiana, was apparently one of the most quiet and sheltered situations known during the Silurian period, and life was as prolific as in any tropical region of the present day.

Large surfaces of the more calcareous layers are covered with numerous forms of Bryozoa and corals; and the abundant roots of Crinoidea, with the bases of the stems, still remain as they grew upon the muddy bottom, the roots penetrating the ancient deposit, or commencing their growth upon some other organic body, and not unfrequently upon the bodies of the same species, or others of the genus which have

been overthrown, and the more fragile portions dismembered by the slow process of maceration in a quiet sea.

From what we know of the locality, it is quite certain that many thousands of the bodies of Eucalyptocrinus have been gathered from the strata within an area of a few hundred yards, and the roots of these bodies, to the number of many hundreds, have been collected and preserved. These organisms appear to have grown in great abundance and in close proximity, with their stems of only moderate length, and the whole aspect must have been like a garden of lilies or tulips.

The specimen figure 5 of plate 17 may serve as an example of the manner of growth. The illustration is from a young individual of *E. crassus*, lying horizontally upon the calcareous shale, the stem turned downward from the natural vertical position to a horizontal one, without breaking or dismemberment, and the rootlets still remaining as they grew, penetrating the calcareous sediment. The prolific condition of this ancient sea is shown from the fact that the stems of crinoids while still living have been overgrown by corals; and shells of Gasteropods, in their most perfect and unworn condition, are overgrown by Bryozoa and Articulata.

The specimen, figure 8 of plate 19, is an example of the base of Eucalyptocrinus, remaining apparently in precisely the original condition, with the rootlets penetrating the calcareous mud in which it grew. The figures 6 and 7 show the bases of columns and the rootlets of two strong individuals attached to the overturned calyx of a large *Eucalyptocrinus cœlatus*. In the vertical view, there are visible two other roots of smaller very young individuals. In the lateral view, figure 7, the rootlets are broken off by the removal of the shale which embedded them, and it is here seen that a Bryozoon has encrusted the rootlet upon one side. These bases of columns and rootlets are also found growing upon the shells of Platyostoma and Strophostylus, as well as upon the calyces of Crinoids.

One of the larger examples of these roots of Eucalyptocrinus is illustrated on plate 20. The extension of the rootlets in their finest fibres has been several inches greater than shown in the figure, and the entire extent was probably not less than ten inches. Portions of specimens sometimes occur where the rootlets are much more extended, becoming quite filiform, but rarely if ever traceable to their final extremities in consequence of the breaking or exfoliation of the shale.

The great numbers of these undisturbed roots and the finer rootlets, standing in the position in which they grew upon the

16

sea-bottom, is one of the best evidences of the extremely quiet condition which prevailed during the slow deposition of these calcareous shales of the Niagara Group.

STEPHANOCRINUS *Conrad.*

STEPHANOCRINUS GEMMIFORMIS.

Plate 14, Figs. 15-20.

Compare *Stephanocrinus gemmiformis* HALL. Pal. N. Y., vol. ii, p. 215, pl. 48, fig. 2.

The details of the structure of the genus STEPHANOCRINUS, and of the species *S. gemmiformis*, are given in vol. 2 of Pal. N. Y., as cited above. The specimens figured on plate 14 of this Report are larger and more rotund than those usually occurring in the Niagara shales in New York, but other specimens from later collections at Waldron are of smaller dimensions, and show a range of variation in size and proportions, which clearly proves the identity of the Western forms with those of New York.

The structure of the calyx and the arrangement of parts in the summit and ambulacra appear to be identical with CODASTER, and a small smooth form in the same association, referred to that genus, has the same structure as the fossil under consideration.

STEPHANOCRINUS GEMMIFORMIS.

CALCEOCRINUS *Hall.*

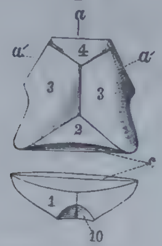
CALCEOCRINUS *Hall.* Pal. N. Y., vol. ii, p. 352, pl. 85, figs. 5, 6. 1852.
CHEIROCRINUS *Hall.* 13th Rep. St. Cab. Nat. Hist., p. 122. 1860.

At the time the genus CHEIROCRINUS was proposed for this form, I overlooked the fact that I had before published a notice of the fossil, though conscious of having studied it; being misled by the absence of any reference in the index of vol. ii, Pal. N. Y., the description being under the head of Additions and Corrections.

The following diagrams illustrate the generic structure:

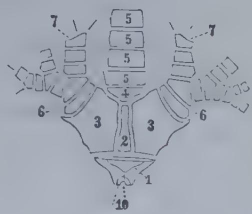
Fig. 1 has the general form and proportions of plates shown in *C. stigmatus* of Plate 19. Fig. 2 shows a different proportion of the parts.

1



CALCEOCRINUS TUNICATUS.

2



CALCEOCRINUS CHRYSALIS.

Fig. 1.—1 The basal plate with cicatrix for the column attachment 10; 2 the dorso-basal plate; 3 3 the dorso-lateral plates; 4 the dorso-radial plate; *a* the face of attachment for the dorsal arms; *á á* faces of attachment for the lateral arms; *c* the faces of attachment for the strong ligament between the basal and lower dorsal plates.

Fig. 2 has the same general structure, except that the dorsal plate 2 is narrow and elongate: 3 4 and 10 have the same significance as in Fig. 1; 5 5 5 5 are plates of the dorsal arm; 6 6 lateral brachial plates; 7 7 the lateral arms and their subdivisions.

CALCEOCRINUS STIGMATUS.

Plate 19, Figs. 9-11.

Cheirocrinus stigmatus HALL. Trans. Alb. Inst., vol. iv, p. 225. Abstract, p. 31; 1862.

In the collection at present before me, this species is illustrated by the basal portions of the body, some fragments of the arms, and a single specimen which preserves the basal plate of the dorsal arm. The dorso-lateral plates are so closely anchylosed that no line of separation is observable, and the same is often true of the dorso-radial plate and the second or lower dorsal plate, which bears upon its lower margin the cicatrices for the muscular attachment of the basal plate. The cicatrices for the three sets of arms are well preserved.

The species differs from any other known to me in the closely anchylosed condition of the dorso-lateral plates, which also involves the lower dorsal plate. The surface is marked by fine granulæ or undulating and tortuous granulose striæ.

BRACHIOPODA.

CRANIA *Lamarck.*

CRANIA SILURIANA.

Plate 21, Figs 3-7.

Crania Siluriana HALL. Trans. Alb. Inst., vol. iv p. 208. Abstract p. 14; May, 1863.
Compare *Crania Siluriana* DAVIDSON. "British Brachiopoda," Part vii, No. 1, pl. 8, figs. 19, 20. 1866.

Shell subcircular or transverse, very depressed-conical, apex excentric, slightly curved, situated one-third the diamter of the shell from the cardinal border. Exterior surface of upper valve smooth, with concentric lines of growth. Ventral or lower valve consisting of little more than a thickened rim, deeply marked on the cardinal margin by the somewhat large, distant, posterior, adductor, muscular scars; the substance within the thickened border, not sufficient to preserve the muscular or vascular markings.

Transverse diameter of full grown specimens nearly 20 mm.; height of upper valve of the same a little less than 6 mm. Where well preserved the surface is minutely granulose or subpunctate.

This species is usually found adhering to other fossils which are in a more or less dilapidated condition; showing that the Craniæ became attached after the death of the individuals on which they are found.

CRANIA SETIFERA.

Plate 21, Figs 8-10.

Crania setifera HALL. Trans. Alb. Inst., vol. iv, p. 209. Abstract p. 15; May, 1863.
(In error) *C. setigera* HALL. Doc. Edit. 28th Rep. St. Mus. Nat. Hist. Explanation of pl. 21, figs. 8-10. 1876.

Shell circular, depressed-convex, apex central or slightly excentric, small, pointed or mammiform. Surface of upper

valve closely covered with minute setiform spines, directed from the apex toward the margin. Ventral or lower valve with the exterior portion merely a calcareous ring, and the central area without any decided character.

When the setæ are removed, the surface appears strongly punctate — a character which distinguishes this form from *C. Siluriana.*

PHOLIDOPS *Hall.*

PHOLIDOPS OVALIS.

Plate 21, Figs 1 and 2.

Pholidops ovalis HALL. Trans. Alb. Inst., vol. iv, p. 209. Abstract p. 15; May, 1863.

Shell round-oval, somewhat broader anterior to the middle; valves equally convex; apex situated about one-third the length of the shell from the posterior end. Surface marked by concentric lines of growth, which are strongly lamellose toward the margin.

This species differs from *P.* (*Orbicula*) *squamiformis* of the Niagara group of New York, in the greater convexity, more closely arranged concentric lines of growth, and in being more regularly and broadly oval. Rare.

ORTHIS *Dalman.*

ORTHIS HYBRIDA *Sowerby.*

Plate 21, Figs 18-25.

Orthis hybrida SOW. MURCH. Sil. Syst., p. 630, pl. 13, fig 11. 1839.
Orthis hybrida SOW. HALL. Pal. N. Y., vol. ii, p. 253, pl. 52, figs. 4*a*-4*o*. 1852.
Orthis hybrida? SOW. HALL. Trans. Alb. Inst., vol. iv, p. 209. Abstract p. 15; May, 1863.

This species is very common in the locality. The numerous specimens examined can be easily separated into two distinct varieties, one of them narrow and ventricose, with the anterior margins thickened and strongly lamellose, presenting strong varices of growth; another, broader and less ventricose, with sometimes a wide sinuosity in front. Few of the specimens have the broad sinuosity of the ventral valve and ventricose upper portion of the shell, so characteristic of the New York species which has been referred to *O. hybrida.*

ORTHIS ELEGANTULA *Dalman.*

Plate 21, Figs 11-17.

For *Synonymy*, see Pal. N. Y., vol. ii, p. 252. 1852.

Compared with the New York representatives, this species, as found at Waldron, is much longer, wider in front, and the beak of the ventral valve not so pointed.

STREPTORHYNCHUS *King.*

STREPTORHYNCHUS TENUIS.

Plate 23, Figs 11-13.

Streptorhynchus tenuis HALL. Trans. Alb. Inst., vol. iv, p. 210. Abstract p. 16; May, 1863.

Shell large, semicircular or broadly semielliptical, cardinal line less than the greatest width of the shell, cardinal extremities rounded. Ventral valve slightly concave; area narrow; beak slightly elevated. Dorsal valve moderately convex, umbo not prominent, arcuate near the front margin, and compressed near the cardinal extremities.

Surface marked by moderately fine, rounded, alternately large and small thread-like striæ, which are strongly curved on the lateral portions of the shell, crossed by very fine concentric striæ, giving, under a lens, a beautiful rugose character. Substance of shell very thin.

Length of one specimen, 40 mm., with a breadth of 50 mm.

This species differs from any other of the genus known to me in rocks of this age, in the rugose surface and rounded cardinal extremities; in this respect it has more the character of the carboniferous forms of Streptorhynchus. But few individuals of the species have been observed in the extensive collections made at the locality.

STREPTORHYNCHUS SUBPLANA (*Conrad*).

Plate 21, Figs. 26-33.

Strophomena subplana CONRAD. Journ. Acad. Nat. Soc. Phil., vol. viii, p. 258. 1842.
Leptæna subplana (CONR.) HALL. Pal. N. Y., vol. ii, p. 259, pl. 53, figs. 8-10. 1852.
Streptorhynchus subplana (CONR.) HALL. Trans. Alb. Inst., vol. iv, p. 226. Abstract, p. 32; May, 1863. 16th Rep. State Cab. Nat. Hist., p. 63. Geol. Rep. Wis. 1862, p. 436.

This species occurs somewhat abundantly, and differs but slightly from the New York form. It is proportionally wider and shows less of the tendency to become mucronate at the cardinal angles.

STROPHOMENA *Raf.*

STROPHOMENA RHOMBOIDALIS *Wilckens.*

Plate 22, Figs. 4-10.

Conchites rhomboidalis WILCKENS. Nachricht von seltener Verst, p. 77, pl. viii, figs. 43, 44. 1769.
For *Synonymy*, see Pal. N. Y., vol. iii, p. 195, under *Strophomena rugosa*; and ibid. vol. iv, p. 76.

This variable species is very abundant, and occurs of somewhat larger size than those figured. Specimens having a width of 50 mm. are not uncommon.

STROPHODONTA *Hall.*

STROPHODONTA PROFUNDA.

Plate 23, Figs. 9, 10.

Leptæna profunda HALL. Pal. N. Y., vol. ii, p. 61, pl. 21, figs. 4, 5. 1852.
Strophodonta profunda HALL. 20th Report State Cab. Nat. Hist., p. 369, pl. 13, figs. 3, 4. 1867. Revised Ed., p. 376, pl. 13, figs. 3, 4. [1870.]

Shell large, broadly semioval, the full grown individuals having a width of about 60 mm. with a length of about 40 mm.; greatest width along the hinge-line; deeply concavo-convex, point of greatest convexity in front of the middle. Cardinal angles slightly extended and subauriculate, in the casts often obtuse or rounded.

Ventral valve very convex, beak slightly elevated, cardinal margin sloping and a little concave to the cardinal angles,

moderately convex for more than half the length, and rapidly descending to the margin. Hinge area narrow ; foramen triangular, width about equal to the height; covered by a strong deltidial callosity. The crenulations or teeth on the interior margin are oblique, diverging from the beak, extending from the foramen less than half-way to the cardinal angles. Muscular impression subtriangular or flabelliform, extending for two-fifths the length of the shell. A central longitudinal callosity extends from the apex, sometimes for one-third of the length of the muscular impression.

Dorsal valve very concave, nearly following the contour of the ventral valve. Hinge area narrower than that of the ventral valve ; foramen covered by a callosity.

Surface marked by strong, large, radiating striæ, alternating with four or five smaller striæ and increasing by implantation ; radiating striæ crossed by very fine, sharp, crowded, regular, continuous, crenulating concentric striæ ; the small radiating striæ often become stronger, forming the larger and less regular striæ ; interior of valves papillose or punctate.

The surface of many of the older specimens is more irregularly fasciculate, and the stronger striæ rise in unequal ridges. This latter feature is, in a greater or less degree, impressed upon the casts of the interior, which, combined with strong vascular markings, gives a distinguishing character to specimens in that condition.

A fine large specimen in the collections from Waldron shows several specific characters not observed in the imperfect material from which the original description was drawn.

STROPHODONTA STRIATA.

Plate 23, Figs. 1-6.

Strophomena striata HALL. Geol. of N. Y. Surv. 4th Geolog. Dist., p. 104, fig. 3. 1843.

Leptæna striata HALL. Pal. N. Y., vol. ii, p. 259, pl. 53, fig. 7. 1852.

This species is of common occurrence in the Waldron locality and the specimens are usually larger than those of the New York fauna. The figures given on plate 23, illustrate the interior structure which I have not been able to observe in any of the specimens from the Niagara formation of New York. In the ventral valve, the muscular area is limited by slightly curving dental lamellæ, and in well-preserved specimens there is a slender ridge along the center; the muscular impressions are

not distinctly marked. The inner cardinal margins of the valves are marked by about fifteen slightly diverging crenulations on each side of the foramen, which occupy little more than one-third of the distance from the center to the extremities of the shell.

STROPHONELLA *n. gen.*

On several occasions, and notably in the *Sixteenth Report on the State Cabinet of Natural History*, and in Vol. IV of the *Palæontology of New York*, I have indicated the existence of a small group of strophomenoid shells which are not strictly included in the genera STROPHOMENA, STROPHODONTA or STREPTORHYNCHUS, though intimately related to these genera. The features are essentially those of STREPTORHYNCHUS in the resupinate position of the valves, and to a great extent in the muscular impressions; but the inner margins of the cardinal areas are crenulate, and the area usually solid with sometimes a triangular deltidium. These forms are separated from STROPHODONTA chiefly by their resupinate character, the strong and more restricted muscular impression of the ventral valve, which occupies a shorter and wider area, and by the muscular area and strong median septum in the dorsal valve. The cardinal process is similar to that of STROPHODONTA and also to some of the Devonian forms of STREPTORHYNCHUS. The characteristic features of these forms are as follows:

Shell semicircular or semielliptical, concavo-convex, resupinate, the ventral valve concave and the dorsal valve convex. Ventral area striated, solid, with or without a central deltidial scar or rarely a partial foramen, and similar features on the narrow area of the dorsal valve; inner margins of the cardinal areas of each valve crenulate, and from beneath the center of the ventral area there is often a strong process (frequently bilobed) which extends beyond the cardinal line. Muscular area of the ventral valve strongly marked, and limited by a prominent border. Dorsal valve with a narrow hinge area transversely or longitudinally striate or both, and marked in the center by a deltidial scar. Cardinal process double, each division notched or bidentate at the extremity; muscular area quadrangular, occupying a more or less elevated callosity, and a central carina rising from the lower part of this area is sometimes produced into a spiniform process in the center of the cavity.

The species at present known to me as possessing the characters of the genus are the following :

Strophonella semifasciata, Niagara group ; *Strophonella Leavenworthana*, *S. cavumbona* and *S. punctulifera* (the two latter probably identical), Lower Helderberg group ; *S. ampla*, Upper Helderberg group ; *S. reversa*, Hamilton group, Iowa ; *S. cœlata*, Chemung group.

STROPHONELLA SEMIFASCIATA.

Plate 22, Figs. 1-3 : Pl. 23, Figs. 7, 8.

Strophomena (Strophodonta ?) semifasciata HALL. Trans. Alb. Inst., vol. iv, p. 210. Abstract, p. 16 ; May, 1863.

Strophomena (Strophodonta) semifasciata HALL. Doc. Edit. 28th Rep. St. Mus. Nat. Hist. Explanation of plates 22 and 23. 1876.

Shell large, concavo-convex, resupinate, transversely semicircular, width nearly twice the length ; cardinal extremities somewhat rounded. Ventral valve with slightly elevated umbo and small pointed beak ; the middle of the shell deeply concave and abruptly inflected toward the front ; area narrow, with a distinct triangular callosity. Dorsal valve depressed-convex from the umbo to near the middle, becoming subgeniculate in front ; area about half as high as that of the ventral valve. Both areas distinctly striate, and marked by crenulations of the inner margin.

Surface of the upper and middle portions of the shell, marked by strong, irregular, distant, rounded, elevated striæ ; near the front of the shell the striæ become more crowded by the intercalation of finer ones. Entire surface marked by fine concentric striæ. Interior surface of valves marked by closely set pustules. Substance of shell very thin.

This species has some resemblance to *Strophomena euglypha* (Dalman), but is much more extended on the hinge-line, the length and breadth being as two to three ; while in that species the proportions are nearly as three to four. This shell has not the fine intermediate striæ, nor the punctate surface represented in that species. It is quite rare, but few specimens having been obtained in the entire collection.

CHONETES *Fischer*.

CHONETES NOVA-SCOTICA.

Plate 22, Figs. 11-14.

Chonetes Nova-Scotica HALL. Silurian and Devonian Rocks of Nova Scotia, by J. W. Dawson, p. 13. 1860.
Chonetes Nova-Scotica HALL. Canadian Nat. and Geologist, vol. v, no. 2, p. 144. 1860.

Shell semielliptical, width varying from once and a half to nearly twice the length, greatest width near the middle. Ventral valve variably convex, and often showing a flattened or slightly concave space down the middle of the shell, with occasionally a stronger and more elevated ray along the median line, from beak to base of the ventral valve; cardinal margin ornamented by from two to five slender spines on each side of the beak; cardino-lateral margins often a little wrinkled. Dorsal valve moderately concave. Surface finely striated, striæ flexuous, dichotomizing and increasing by interstitial addition so that there are more than one hundred on the margin of the shell, stronger below the umbo; concentric striæ fine, close, rounded and slightly undulating.

This species resembles in form the *Chonetes cornuta* of the Clinton group of New York, but is a larger and more ventricose shell; the striæ are proportionally less numerous and more closely arranged, the interstices being less than the striæ, while in *C. cornuta* the interstices are wider than the striæ, and the latter increase only by interstitial additions below the middle of the shell.

All the specimens from Waldron belong to the variety with a strong median ray on the ventral valve. One specimen observed has a width of 16 mm.—considerably greater than the individuals figured.

Not common.

CHONETES UNDULATA *n. sp.*

Plate 22, Fig 15.

Chonetes minima HALL. Doc. Edit. 28th Rep. St. Mus. Nat. Hist. Explanation of pl. 22, fig. 15. 1876. Not *Chonetes minima* SOWERBY., 1839.

Shell semicircular, length equal to six-tenths of the width, cardinal line straight, greater than the width of the shell

below. Ventral valve regularly convex, the greatest convexity about the middle of the shell, somewhat abruptly curving to the anterior margin, cardinal angles very slightly flattened. Dorsal valve concave, ventral area linear, extending to the hinge extremities; foramen equal in height to the ventral area and wider than high. Dorsal area indicated only by the thickness of the shell.

Surface marked by obscure radiating plications which are broad and rounded below, and obsolescent toward the beak; cardinal margin of the ventral valve ornamented by two diverging spines on each side of the beak.

This species is especially characterized by the rounded plications, which are frequently obscure and often obsolescent on the center of the valve, where they appear as simple undulations of the surface. The bases of two spines on each side of the beak are usually preserved, and no specimen examined has shown more than that number.

SPIRIFERA *Sowerby.*

SPIRIFERA EUDORA.

Plate 24, Figs 13–18.

Spirifer Eudora HALL. Ann. Geolog. Report Wisconsin. 1861.
Spirifer Eudora HALL. Trans. Alb. Inst., vol. iv, p. 211. Abstract p. 17; May, 1863.
Spirifera Eudora HALL. 20th Rept. State Cab. Nat. Hist., p. 370, pl. 13, figs. 5, 7. 1867. Revised Edit., p. 377, pl. 13, figs. 5, 7. [1870.]
Compare *S. Niagarensis* var. *oligoptycha* F. ROEMER. Sil. Faun. Westl. Tenn., p. 68, pl. 5, fig. 8.

This species was originally described from casts from the limestone of Racine, Wisconsin. The casts show a higher area than the entire specimens, since the strongly incurved beak of the ventral valve covers much of the area, giving a less distance between the beaks of the opposite valves than is shown in the casts. The surface is marked by fine radiating striæ, which are precisely of the character of those of *S. macropleura* of the lower Helderberg group.

The species given by Roemer as *S. Niagarensis* var. *oligoptycha* differs from this species in the proportionally longer hinge-line; and when compared with specimens of *S. macropleura* from Tennessee, presents no essential differences of character.

SPIRIFERA CRISPA (*Hisinger*).

Plate 24, Figs 6-12 and 19.

For *Synonymy* and description of species, see Pal. N. Y., vol. ii, p. 262. 1852.

This species occurs in considerable numbers in the Waldron collections, presenting the same variety of form and proportions that we find in the same species in New York. Many of the specimens, however, are larger and more rotund than the latter.

There seems to be no sufficient reason for separating this form from *S. crispa* of Europe.

SPIRIFERA CRISPA var. SIMPLEX *n. var.*

Plate 24, Figs 1-5.

Spirifer crispus var. HALL. Trans. Alb. Inst., vol. iv, p. 212. Abstract p. 18; May, 1863.

There are numerous small symmetrical specimens which have almost uniformly a single plication on each side of the mesial fold, presenting three folds of nearly equal size. The ventral valve has two folds on each side of the mesial sinus, and the valves are almost equally convex. The surface is marked as in the larger specimens.

SPIRIFERA RADIATA *Sowerby*.

Plate 24, Figs 20-30.

For *Synonymy*, see 20th Rept. State Cab. Nat. Hist., p. 371. 1867.

Large and fine specimens of this species are found in considerable abundance. The individuals are larger and in a much finer state of preservation than those found in the Niagara shales of New York. The form is more rotund, the cardinal extremities more distinctly rounded, the ventral area of moderate height and distinctly striated longitudinally, and the foramen is often partially covered by a deltidium. The aspect of the interior of a well-preserved specimen of the ventral valve, as it occurs at Waldron, is well represented by fig. 25, of plate viii, in Mr. Davidson's *Introduction to the Study of the Brachiopoda*.

This form is regarded by Mr. Davidson and other authors, as a variety of *S. plicatella* of Linneus, but I have never seen among the American specimens any individual showing

plications like the English and continental European specimens. The Waldron specimens have usually the form of those illustrated by Mr. Davidson* as *S. plicatella* var. *globosa.* This author says, in regard to the surface of the *S. plicatella* var. *radiata*, that "the external sculpture, when "well preserved, is extremely beautiful, and consists of radiat-"ing ribs (five in the width of a line in the middle of an "average sized specimen), not always quite regular in their "respective widths, but usually leaving an interspace between "each two of about the width of one of the ribs, and at times "toward the margin, there are smaller ribs interpolated; these "ribs are regularly crossed by equidistant, concentric, pro-"jecting ridges, which give to the shell surface a beautifully "imbricated appearance." This description of the character of surface of the English specimens is scarcely applicable to the American specimens which we refer to *S. radiata.* In the Waldron specimens, the radii are finer than above described, there being eight or more in the width of a line, while the interspaces are not more than half as wide as the radii. The radii are also distinctly flattened and are increased by bifurcation or dichotomizing, and rarely by intercalation of smaller striæ. These characters are illustrated in figure 30 of plate 24. The concentric striæ are obscurely visible or obsolete. Of the *Spirifera plicatella* var. *globosa*, Mr. Davidson says: "It is easily connected with *Spirifera radiata* of Sowerby. Indeed, there appears to be little by which it can be distinguished from the true *Spirifera radiata*, except the greater convexity or gibbosity of its valves and its finer striation."

The *Spirifera Niagarensis*, which has a similar form and surface markings is distinctly plicate, but it is not known to present the elevated area, incurved beak, and gibbous form, which is represented in the European specimens of *S. plicatella.* In the Niagara shales in the State of New York the *S. Niagarensis* is abundant, while *S. radiata* is comparatively rare. At Waldron *S. radiata* has acquired a remarkable development in numbers and in the size of the specimens, but we have not observed a single specimen of *S. Niagarensis* in all the collections made at that locality.

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* *Monograph of British Fossil Brachiopoda*, p. 89, pl. 9, figs 7 and 8.

MERISTELLA *Hall.*

Subgenus MERISTINA *Hall.*

MERISTINA MARIA.

Plate 25, Figs. 8-12.

Meristella Maria HALL. Trans. Alb. Inst., vol. iv, p. 212. Abstract p. 18; May, 1863.
Meristina Maria HALL. Pal. N. Y., vol. iv, p. 299. 1867.

Shell of medium or large size, ventricose, broadly ovate or subquadrangular. Ventral valve gibbous above, with a subangular ridge extending from the beak to near the middle, where it becomes flattened, sinuate and bent abruptly upward in a prolonged linguiform extension; beak obtuse, closely incurved over the opposite valve; cardinal slopes angular and the cardinal border inflected. Dorsal valve gibbous, strongly arcuate transversely, prominently subangular along the middle, and in the lower part presenting a broad undefined fold, deeply emarginate in front for the reception of the extension of the opposite valve; beak obtuse, strongly incurved.

Surface marked by strong concentric lines of growth. Interior of ventral valve marked by two strong diverging dental lamellæ which extend to near the middle, limiting a deep triangular muscular cavity.

This species is most nearly related to *Meristella* (*Merista*) *tumida* of European authors, but is less rotund, while that species does not possess the peculiar flattening of the cardinal half of the ventral valve and its accompanying subangular ridge. It differs from all the other species of the Niagara and lower Helderberg groups, but approaches in some characters to the *Meristella* (*Atrypa*) *crassirostra* of the Niagara group (Pal. N. Y. vol. ii). The *M. nitida* occurs with this species, and is readily distinguished from it by its emarginate front, and the absence of an elevated fold on the dorsal valve.

Very abundant at the Waldron locality.

MERISTINA NITIDA.

Plate 25, Figs. 1-7.

Atrypa nitida HALL. Geol. of N. Y. Surv. 4th Geolog. Dist. Tab. of Organic Remains, p. 11, no. 14 (no. 13 on plate), fig. 5. 1848.
Atrypa nitida HALL. Pal. N. Y., vol. ii, p. 268, pl. 55, figs. 1 *a*-1 *o*. 1852.
Merista nitida HALL. 12th Report State Cab. Nat. Hist., p. 78. 1859.
Meristella nitida HALL. Trans. Alb. Inst., vol. iv, p. 226. Abstract p. 32; May, 1863.
Meristina nitida HALL. Pal. N. Y., vol. iv, p. 299. 1867.

This species is very abundant and variable in character, and much larger than the New York specimens of this shell. The form varies from narrow ovate and very ventricose to broadly rhomboid ovate and strongly emarginate in front.

NUCLEOSPIRA *Hall.*

NUCLEOSPIRA PISIFORMIS.

Plate 25, Figs. 22-28.

Orthis pisum (MURCH.) HALL. Pal. N. Y., vol. ii, p. 250, pl. 52, figs. 1 *a*-1 *e*. 1852.
Nucleospira pisiformis HALL. Pal. N. Y., vol. iii, Expl. pl. 28 B. 1859.
Nucleospira pisiformis HALL. Trans. Alb. Inst., vol. iv, p. 226. Abstract, p. 32; May, 1863.

This species is common. Many of the specimens are almost entirely covered with long fine setæ projecting beyond the margins, forming a marginal fringe.

RETZIA *King.*

RETZIA EVAX.

Plate 25, Figs. 13-21.

Rhynchospira evax HALL. Trans. Alb. Inst., vol. iv, p. 213. Abstract p. 19; May, 1863.

Shell ovate, often broadly ovate, usually longer than wide, sometimes much longer; both valves gibbous in the middle and upper part, ventral valve a little deeper than the opposite, both valves sometimes marked by a shallow undefined sinus, causing an emargination in front. Ventral beak much elevated above the other, and incurved, so as to bring the plane of the foramen parallel to the axis of the shell; foramen dis-

tinctly rounded, with a visible triangular space below, which is occupied by two small deltidial plates. Dorsal valve regularly arcuate except near the front; beak closely incurved beneath the deltidial plates of the opposite valve. In some old specimens there is a broad undefined mesial elevation on the lower part of the valve including about five or six plications besides the central one, which is divided into two or three smaller ones (a generic feature). Sometimes there is a broad, undefined depression and frequently only a narrow depression caused by the subdivided central plication. The ventral valve has uniformly a longitudinal sinus, which includes two or three small plications arising from the subdivision of the central one, and sometimes including one or two on each side.

This shell is marked by radiating rounded or subangular costæ or plications, from eight to fourteen on each side of the central one; those on the cardinal slopes sometimes bifurcating or with interstitial additions, while in a few individuals bifurcating costæ occur on other parts of the valve; the interspaces are rounded grooves of about the same size as the plications. The surface is marked by fine concentric striæ and stronger, imbricating lamellose lines of growth.

This species differs from *R.* (*Atrypa*) *aprinis* of the Niagara group of New York, in being more ovate in form and less gibbous toward the front, while the ventral beak is more elevated. It approaches very nearly in character to the *R. formosa* of the Lower Helderberg group, and the shell is subject to similar variations of form, proportions and incurvation of the beak, which in some specimens of both species is closed upon the opposite beak. The central plication in both species is divided into two or three, and the dorsal valve likewise presents sometimes a mesial elevation and sometimes a depression.

The largest individual measured has a length of more than 25 mm., with a width nearly as great. The specimens vary from 2 mm. to about 25 mm. in length.

This species is comparatively numerous.

CŒLOSPIRA *Hall.*

CŒLOSPIRA DISPARILIS.

Plate 25, Figs 39-43.

Atrypa disparilis HALL. Pal. N. Y., vol. ii, p. 277, pl. 57, figs. 6*a*-6*m*. 1852.
Leptocœlia disparilis HALL. 10th Rep. St. Cab. Nat. Hist., p. 108. 1857.

This species is comparatively rare. The specimens from the Waldron locality show considerable variation in form, convexity of the valves, and number of plications. Compared with specimens of *Retzia Barrandii* (Davidson, 1848) from Dudley, England, they seem to be very closely related, if not identical.

ATRYPA *Dalman.*

ATRYPA RETICULARIS (*Linn.*).

Plate 25, Figs 44-47.

For *Synonymy*, see Pal. N. Y., vol. iv, p. 316. 1867.

This is a very abundant species. Many of the specimens are more rugose than is usual in other localities. The concentric lamellæ are often produced and divided into subtubular short spines.

RHYNCHONELLA *Fischer.*

RHYNCHONELLA NEGLECTA.

Plate 26, Figs 1-6.

Atrypa neglecta HALL. Pal. N. Y., vol. ii, p. 274, pl. 57, figs. 1*a*-1*p*. 1852.
Rhynchonella neglecta HALL. 12th Rep. St. Cab. Nat. Hist., p. 78. 1859.

This is a common species at Waldron. It varies somewhat from the New York specimens in its decidedly more angular form, sharper plications, deeper and more prolonged sinus.

RHYNCHONELLA ACINUS.

Plate 26, Figs. 7–11.

Rhynchonella acinus HALL. Trans. Alb. Inst., vol. iv, p. 215. Abstract, p. 21; May, 1863.

Shell small, longitudinally ovate, subattenuate toward the beak, and truncate in front, valves subequally convex. Ventral valve subarcuate, flattened in the middle, below which it is sinuate; beak incurved. Dorsal valve somewhat flattened in the middle, and sometimes a little depressed in the upper part of the median line, two of the plications becoming elevated toward the front, corresponding to an abruptly depressed sinus in the ventral valve, in the bottom of which is a single plication; three and rarely four plications on each side of the mesial fold of the dorsal valve, and four on each side of the sinus of the ventral valve. Concentric lines of growth usually but faintly marked.

Length from 5 to 10 mm.; length and breadth usually about as four to three, and the depth about equal to the width, giving a subquadrate transverse section.

This species differs from the *R. bidentata* of Hisinger, in being larger, more robust and ventricose, and proportionally more elongate; the plications are more rounded, and the whole aspect less angular. It approaches in form the *R. bialveata* of the Lower Helderberg group, but it is more robust, and the plications are more rounded.

RHYNCHONELLA INDIANENSIS.

Plate 26, Figs. 12–22.

Rhynchonella Indianensis HALL. Trans. Alb. Inst., vol. iv, p. 215. Abstract, p. 21; May, 1863.

Shell broadly ovate or subtriangular, length and width nearly equal, the width sometimes exceeding the length; cardinal slopes in the more gibbous specimens, flattened. Ventral valve with the beak pointed and incurved, depressed-convex in the middle and gradually becoming depressed and sinuate in front, two or three of the plications included in the sinus. Dorsal valve a little the more gibbous, somewhat flattened

forward of the umbo ; three or four of the plications continuing direct, and forming a mesial elevation, the lateral ones arching downward to the margin. Shell marked by from nine to twelve strong, rounded or subangular plications, which sometimes become obsolete toward the beak. The concentric lines are very obscure. Length about 13 mm.

This species resembles the *R. neglecta* of the Niagara group of New York ; but it is larger and more robust, with stronger and more rounded plications ; it is associated with a more finely plicated species which I have identified with that one.

RHYNCHONELLA WHITII.

Plate 26, Figs. 23-33.

Rhynchonella Whitii HALL. Trans. Alb. Inst., vol. iv, p. 216. Abstract, p. 22; May, 1863.

Shell subcircular or transverse and broadly elliptical, usually not very gibbous. Ventral valve shallow, most prominent on the umbo, beak abruptly attenuate and pointed, slightly incurved, sides flattened, strongly sinuate in the middle and gently curving upward in front. Dorsal valve more gibbous ; beak obtuse and incurved beneath the opposite, elevated in the middle, forming a distinct mesial fold, arching on the sides ; from five to six strong plications on each side of the mesial fold and sinus, with usually a single plication in the sinus, and two on the mesial fold ; rarely one of the plications on the fold is bifurcate. Interspaces wider than the plicacations. Surface marked by close concentric lines of growth.

This species bears some resemblance to *R.* (*Atrypa*) *dentata* (Pal. N. Y., vol. i, p. 148), but is less gibbous, the plications less strong, the mesial fold less elevated, and the sinus much narrower. It also is related to *R. borealis* Schloth. (Davidson's British Fossil Brachiopoda, No. iii, Pt. vii, p. 174, Pl. xxi, figs. 14–23), and is distinguished by its smaller and rounded form, less prominent plications, and by its surface-markings.

RHYNCHONELLA STRICKLANDII ? (SOWERBY).

Plate 26, Figs. 34-40.

Terebratula Stricklandi J. DE C. SOW. Sil. Syst., pl. 13, fig 19. 1839.
Terebratula crispata Id., pl. 12, fig 11. 1839.
Terebratula Stricklandi DAV. Bull. Soc. Geol. France, 2d Ser., vol. 5, p. 329. 1848.
Hypothyris Stricklandi D'ORBIGNY. Podrome, vol. i, p. 37. 1849.
Hypothyris Stricklandi MCCOY. Brit. Pal. Foss., p. 206. 1855.
Rhynchonella Stricklandi MORRIS. Catalogue of British Fossils, p. 146. 1854.
Rhynchonella Stricklandi SALTER. Siluria, 2d ed; pp. 250, 544, pl. 22, fig. 11. 1859.
Rhynchonella Stricklandi LINDSTROM. Of v. K. Vet. Akad. Forhandl., p. 366. 1860.
Compare *Rhynchonella Tennesseënsis* ROEMER. Sil. Faun. Westl. Tenn., p. 72, pl. 5, fig. 14. 1860. HALL. Trans. Alb. Inst., vol. iv, p. 228. Abstract, p. 34; May, 1863. HALL. Doc. Edit. 28th Rep. St. Mus. Nat. Hist., pl. 26, figs. 34-40. 1876.

The individuals belonging to this species were originally identified with *R. Tennesseënsis* Roemer, a species described from the middle Silurian of Tennessee. The specimens from Waldron, in their prevailing forms, are much larger than the figures of Dr. Roemer, and the plications less angular than represented. The species now under consideration occurs in Tennessee, but is always smaller, and in that respect corresponds with the figures cited above. There is, however, another form, occurring with those of the Tennessee locality, which is shorter and comparatively broader, with more angular plications and abrupt thread-like transverse striæ, a more abrupt sinus and more acute beak. This form corresponds with the figures of Dr. Roemer, but it is quite unlike the specimens from Waldron.

A comparison of the Waldron specimens, and of the similar Tennessee form, with the figures of Mr. Davidson in his monograph of the Fossil Brachiopoda of Great Britain, indicates the specific identity of the specimens from these three localities. The Waldron specimens differ from those of Dudley, England, in being less gibbous, proportionally longer, the beak slightly more extended, the ventral valve nearly flat in a transverse direction across the upper half of the shell, the plications larger and more rounded, the sinus wider and less abrupt. The same differences are observed in comparison with the original figures of Sowerby (cited above,) in the *Silurian System*. In both the works cited, however, the figures agree much more nearly with the Waldron specimens than those of Dr. Roemer.

RHYNCHOTRETA *n. gen.*

Type, *Rhynchonella cuneata* DALMAN.

Shell triangular, surface with angular plications. Ventral beak straight, produced beyond the dorsal beak, extremity perforate, the foramen with an elevated margin; space between the foramen and hinge-line occupied by a deltidium in two pieces, being divided by a longitudinal suture, and transversely striated. Valves articulated by two slender curving teeth, proceeding from a broad curving hinge-plate in the ventral valve, which fit into corresponding sockets in the dorsal valve. Cruræ rising from near the dorsal beak, and curving into the ventral cavity, and thence recurved toward the dorsal side, and probably uniting, as shown in figure 4, p. 167. Structure fibrous and apparently very minutely punctate.

The *Rhynchonella cuneata* of Dalman has been retained under that genus by nearly all authors. In 1859, Salter referred the species to RETZIA.* An examination of specimens in my possession, in 1863, revealed no satisfactory evidence of punctate structure, or internal cruræ or spires; and I still continued it under RHYNCHONELLA. The collections from Waldron have shown the punctate texture of the shell, and the existence of long curving crura, which are unlike any feature known in palæozoic RHYNCHONELLA, and assimilate this fossil to the Terebratulidæ.

This form is not congeneric with *Retzia Adrieni*, and cannot properly be referred to that genus, though approaching in external characters to *R. ferita*, which is represented as possessing internal spires. It becomes necessary, therefore, to characterize it as a distinct genus, for which I have proposed the name RHYNCHOTRETA. The accompanying figures illustrate its principal features.

* Siluria, 2nd Edition, pl. xxii, fig. 8. 1859.

Fig. 1.

Fig. 2.

Fig. 3.

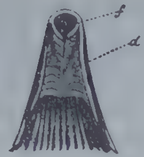

Fig. 4.

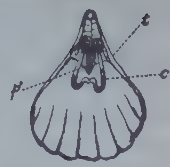

Fig. 1. Dorsal view, showing extent and divergence of the crural processes *c*, and one of the articulations of the ventral valve *t*.

Fig. 2. Lateral view, showing curvature and direction of crural processes.

Fig. 3. Enlargement to four diameters of the beak, showing the characters of the deltidium and foramen.

Fig. 4. Interior of ventral valve, and a portion of the dorsal valve, showing the attachment of the cruræ.

c. Cruræ uniting by a loop.

p. Hinge-plate, or pedicle sheath.

t. Articulations.

The additional features of the loop represented in this figure have not, as yet, been satisfactorily determined; all the positive evidence indicates this to be the arrangement and development of the parts shown in figs. 1 and 2.

RHYNCHOTRETA CÙNEATA var. AMERICANA *n. var.*

Plate 25, Figs. 29-38.

Shell triangular, cuneiform, longer than wide, greatest width near the front, and tapering posteriorly into an angular beak. Valves moderately convex, the dorsal sometimes gibbous; ventral beak elongated, foramen subcircular, formed by the extremity of the beak and a portion of the area below, which is separated from the hinge-line by a deltidium in two pieces; sides of the beak compressed, flat or concave. Sinus wide, deep or shallow, according to the development of the shell, commencing at one-third the length of the shell from the beak, and becoming very conspicuous in front. Dorsal valve the more convex, the mesial fold beginning as a depression just below the beak, and becoming very prominent on the lower half of the shell. Surface marked by nine or ten strong angular plications on each valve, of which three are depressed in the sinus, and four are elevated on the mesial fold—the two central ones being much the more prominent; the plications are crossed by numerous, regular, fine thread-like striæ. The entire surface is minutely papillose.

This species is very common in the Waldron locality. The specimens are larger and in a better state of preservation than is usual in the New York localities.

Compared with its European congener, the American form is a more robust and larger shell, the surface marked by fewer and much stronger plications; while the transverse striæ are a little finer and less distant, and the sinus is much deeper and more abrupt.

Specimens from Waldron, Indiana, from New York and from Dudley, England, have been cut on the dorsal side, and all show the crural processes, as in figure 1 of the accompanying illustrations.

ANASTROPHIA *Hall.*

ANASTROPHIA INTERNASCENS *n. sp.*

Plate 26, Figs. 41-49.

Compare *Atrypa interplicata* (SOW.) HALL. Pal. N. Y., vol. ii, p. 275, pl. 57, figs. 2*a*-2*g*. Not *Terebratula interplicata* (SOW.) MURCH. Sil. Syst., p. 631, pl. 13, fig. 28.
" *Atrypa brevirostris?* (SOW.) HALL. Pal. N. Y., vol. ii, p. 278, pl. 58, figs. 1*a*-1*f*. Not *Terebratula brevirostris* (SOW.) MURCH. Sil. Syst., p. 631, pl. 13, fig. 23.
" *Pentamerus Verneuili* HALL. Pal. N. Y., vol. iii, p. 260, pl. 48, figs. 1*a*-1*y*.
" *Anastrophia Verneuili* HALL. Pal. N. Y., vol. iv, p. 374.
" *Brachymerus* SHALER. Bull. Mus. Comp. Zoöl, vol. 1. 1865.
Anastrophia Verneuili HALL. Doc. Edit. 28th Rept. St. Mus. Nat. Hist. Explanation of pl. 26, figs. 41-49. 1876.

Shell transversely subelliptical, ovoid or subglobose in different stages of growth, the proportions of length and width being sometimes nearly equal. Valves of young specimens nearly equal in convexity; in older ones the dorsal valve becomes the more gibbous.

Ventral valve moderately convex in young or medium-sized specimens, and gibbous in the upper part in older specimens; the anterior portion depressed and marked by a broad undefined sinus; beak short, acute, closely incurved over the umbo of the opposite valve; area small, short and sharply defined. Dorsal valve gibbous, and in old individuals the umbo projects beyond the beak of the ventral valve, with the apex incurved beneath the beak of the latter; central portion of the valve toward the front more elevated, and sometimes presenting a broad undefined mesial fold.

Surface plications abruptly elevated, rounded, angular or

subangular, becoming depressed and sometimes obsolete on the cardinal slopes, usually simple, enlarging toward the front of the shell, rarely bifurcating or with an intercalated one on the middle of the shell, but bifurcating or intercalating in a remarkable manner on the sides, where the folds bend abruptly outwards to the cardino-lateral margins; plications crossed by arching imbricating striæ of growth, which are sometimes very conspicuous.

The individuals of this species measure from 11 to 17 mm. in length, from 12 to 19 mm. in width, and 9 to 12 mm. in depth.

This form, from the Waldron locality, differs from the *Anastrophia* (*Atrypa*) *interplicata*, ut cit. of the Niagara group of New York in its larger growth, with more rounded or less angular plications, and in being almost free from intercalated plications, which are constant and characteristic in that species, and in having no defined mesial sinus, which is always a feature in the New York form. Similar features are described as characteristic of *A. brevirostris*, of which I have no good specimens before me. It is quite probable that these New York forms, which are described as two species, are in reality but varieties of the same.

Noting these differences between the New York specimens and those from Waldron, I had originally (*Transactions Albany Institute*, vol. iv, p. 227) indicated the latter as more nearly approaching to *A. Verneuili*, from the Lower Helderberg group in New York. They however present several marked differences; this form is smaller, more rounded and less ventricose; the umbones less prominent and not so closely incurved; the sinus rounded and undefined, never deep nor angular; the plications more rounded, generally continuous to the beaks, and occasionally increasing by implantation or bifurcation, while the latter is a constant character in *A. Verneuili*.

EICHWALDIA *Billings.*

EICHWALDIA RETICULATA.

Plate 26, Figs. 50-54.

Rhynchonella reticulata? HALL. Trans. Alb. Inst., vol. iv, p. 217. Abstract, p. 23; May, 1863.
Eichwaldia reticulata HALL. 20th Rept. St. Cab., Nat. Hist., p. 275. 1867.

Shell varying from elongate-triangular to transversely

elliptical, gibbous in the upper part, more attenuate in front, cardinal slopes flattened in most specimens, sometimes rounded. Ventral beak small, acute, flattened on the back, and closely incurved; the front half of the ventral valve marked by a broad, shallow, sometimes undefined sinus. Dorsal valve usually more ventricose, beak obtusely pointed and strongly incurved, a low, broad, scarcely defined mesial elevation marks the center and often occupies nearly one-third the entire width of the valve; often this fold is obsolete, leaving the valve regularly arcuate from side to side, while in other specimens the borders are depressed and the shell flattened in front.

Surface of the shell, except a small space on the umbo of the ventral valve, covered by a finely reticulate marking, with elongate, generally hexagonal pits or openings, with thin and sharp ridges between; these markings vary in different specimens, and also on different parts of the same individual, being generally finest on the cardinal slopes. The small triangular space near the ventral beak, which is destitute of marking, has the appearance of having been exfoliated, but since this is an invariable character in all the individuals examined, varying in size with the size of the shell, it is probably dependent upon organic causes.

This species resembles *Atrypa* [*Eichwaldia*] *corallifera*, Pal. N. Y., vol. ii, p. 281, but differs in being much broader and less ventricose, and also in the greater breadth and less prominence of the mesial fold.

LAMELLIBRANCHIATA.

AMPHICŒLIA *Hall.*

AMPHICŒLIA LEIDYI.

Plate 27, Fig. 1 and Fig. 2?.

Amphicœlia Leidyi HALL. 20th Rep. St. Cab. Nat. Hist., p. 339, pl. 14. figs. 13-15. Rev. Edit., p. 387.

The specimens from Waldron, which I have referred to this species, are in the condition of casts of the interior, and are more or less flattened in the soft shales. The fossil preserves the usual rhomboidal form of the species; the beak is much elevated, and this feature, in the specimen fig. 1, is apparently increased by the pressure to which the shell has been subjected. The hinge-line is more oblique than in the typical forms of the species, but this may be due to pressure.

The casts preserve some remains of concentric striæ, but there is no evidence of the fine radiating striæ which are characteristic of the genus. The length of the shell is equal to the height, as shown in specimens from other localities.

The specimen fig. 2, has a length greater than the height, the beak is less elevated and at a greater distance from the anterior margin, giving a more equilateral aspect to the fossil. This may be a distinct species, but owing to the condition in which the specimens occur, it would be impossible to indicate specific characters beyond the general form of the shell.

Almost all the specimens of Lamellibranchiata from the Waldron locality are in the condition of casts of the interior, the shell having been dissolved, while the shaly material, with which it was filled, preserves the characters in a very imperfect manner.

AMBONYCHIA ACUTIROSTRA.

Plate 7, fig. 12.

Ambonychia acutirostra HALL. 20th Rep. St. Mus. Nat. Hist., p. 336, pl. 14, fig. 2. 1867; Rev. Edit., p. 383.
Ambonychia acutirostra HALL. Under reference to *Sagenella elegans*. Doc. Edit. 28th Rep. St. Mus. Nat. Hist. Explanation of pl. 7, fig. 12. 1876.

Shell narrow ovate, subequilateral, length nearly twice the width; valves moderately convex, sloping very abruptly to

the anterior margins; posterior margins flattened; beak acute, not elevated, projecting beyond the cardinal margin; cardinal line straight. Substance of shell very thin, showing lamellose lines of growth; margin depressed, crenulated from the impression of the surface striæ.

Most of the specimens are obscure casts of the interior, and present few characters beyond the general form.

Compared with *A. aphæa* HALL, a species with which it is associated in Wisconsin and Illinois, it is longer, with the beaks more elongate and attenuate. It many respects it resembles the *Myalina mytiliformis* HALL, of the Clinton group (Pal. N. Y., vol. ii, p. 100); but it is proportionately wider, and the beaks more attenuate.

MODIOLOPSIS *Hall.*

MODIOLOPSIS PERLATUS.

Plate 27, Figs. 3, 4.

Modiolopsis perlatus HALL. Doc. Edit. 28th Rep. St. Mus. Nat. Hist. Explanation of pl. 27, figs. 3, 4. 1876.

Shell ovate, moderately convex, the greatest convexity a little anterior to the middle of the shell. Beaks slightly elevated above the hinge-line and scarcely more than one-fifth the length of the shell from the anterior end; the greatest width of the shell about midway between the beak and the posterior extremity. The straight hinge-line extends about half the distance from the beak to the posterior extremity, thence curving into the posterior slope. Basal margin a little contracted immediately below the beak, and thence curving into the broadly rounded posterior extremity. Surface marked by fine lines of growth with a few stronger undulations.

Length of the shell three and a half centimetres; width two and a half centimetres.

This shell differs from characteristic forms of *M. subalatus* in the more ascending direction of the hinge-line from the beak, the broader and more regularly rounded posterior extremity, and the lesser constriction of the basal margin beneath the beak.

MODIOLOPSIS SUBALATUS.

Plate 27, Figs. 5, 6.

Modiolopsis subalatus HALL. Pal. N. Y., vol. ii, p. 84, pl. 27, figs. 5 and 6. 1852.

Shell rhomboidal ovate, the proportions of length and breadth varying in different individuals, one of the specimens figured having a length once and three-fourths as great as the width, while the other is less than once and a half as long as wide. Hinge-line equaling or greater than one-half the length of the shell; umbo prominent, beak moderately elevated above the cardinal line; posterior side broadly rounded and subalate above; anterior side narrow, rounded or subacute; basal margin anterior to the center, and nearly beneath the beak, more or less distinctly arcuate. Surface marked by fine concentric lines of growth.

Length of shell 31 to 37 mm.; greatest width 22 to 23 mm.

The specimens from Waldron are much larger than those known in New York, but they are in other respects similar. Without a greater amount of material for comparison, I do not feel warranted in making any specific distinction.

PTERINEA *Goldfuss.*

PTERINEA BRISA.

Plate 27, Figs. 7-9.

Pterinea brisa HALL. 20th Rep. St. Cab. Nat. Hist., p. 337, pl. 14, fig. 1. 1867. Rev. Edit., p. 384. 1870.

Compare *Avicula emacerata* CONR. HALL. Pal. N. Y., vol. ii, p. 282, pl. 59, figs. 1a-1e. 1852.

Compare *Ambonychia (Pterinea) striæcostata* MCCHESNEY. New Pal. Foss., p. 88, pl. 9, fig. 4; and Trans. Chic. Acad. Sci., vol. i, p. 88, pl. 9, fig. 4. 1869.

Body of shell (left valve) obliquely subovate, extremely inequilateral; anterior wing moderately extended and strongly sinuate at its junction with the body; posterior wing not extending as far as the posterior extremity of the shell; umbo prominent, beak rising a little above the hinge-line; muscular impression in right valve large and nearly round, near the middle of the length of the shell. In the casts, beneath or just anterior to the beak, there is one short curving dental

pit, with a smaller accessory one. This is a feature not observed in the Waldron specimens, which are usually found as the exteriors and often as imperfect interiors of the valves; the few casts which have been observed from this locality, do not show the muscular marking.

Surface marked by strong radiating and concentric striæ, with broad, little elevated, radiating ribs. The concentric striæ of growth are produced into prominent, recurving, fimbriated laminæ, the fimbriæ being infolded at their margins and bending backward in the form of long, hollow, semicylindrical spines, leaving a broad sinus between, in the bottom of which is a shorter spine. The younger specimens, as usually preserved, present simple fimbriated lamellæ.

MYTILARCA *Hall.*

MYTILARCA SIGILLA *Hall.*

Plate 27, Fig. 10.

Mytilarca sigilla. Doc. Edit. 28th Rep. St. Mus. Nat. Hist. Explanation of pl. 27, fig. 10. 1876.

Body of the shell ovate-acute, broadly rounded at the base alate posteriorly; hinge-line oblique. Length sixteen millimetres.

The specimen is a cast of the interior, and the surface-markings are unknown.

CYPRICARDINIA *Hall.*

CYPRICARDINIA ARATA.

Cypricardinia arata HALL. 20th Rep. St. Cab. Nat. Hist., p. 337, plate 14, fig. 6. 1867. Rev. Edit., p. 385. 1870.

Compare *Cypricardinia subovata* MILLER and DYER. Contributions to Palæontology, No. 2. 1878.

Shell subovate, varying from moderately to extremely gibbous, slightly alate at the postero-cardinal margin; beaks near the anterior end, which is short and rounded. Surface marked by strong concentric lamellose ridges.

The specimens from Waldron present no marks of specific distinction from those of the Niagara limestone of Wisconsin.

GASTEROPODA.

PLATYOSTOMA *Conrad.*

PLATYOSTOMA NIAGARENSE.

Plate 28, Figs. 1-12; Plate 29, Figs. 1-15.

Platyostoma Niagarensis HALL. Pal. N. Y., vol. ii, p. 287, pl. 60, figs. 1*a*-1*v*. 1852.

Shell ovoid or subglobose, volutions three to four, the last one very ventricose, spire varying from the plane of the outer volution to an elevation of one-fifth or one-fourth the height of the shell above.

Apex minute, somewhat rapidly expanding, the first two volutions usually symmetrical; the outer volution often unsymmetrical, very ventricose and regularly rounded upon the back, but not unfrequently extended and becoming free toward the aperture, and marked on the upper or lower side, or upon both, by a groove, along which the striæ are abruptly bent, indicating a sinus in the peristome during some period of its growth; peristome entire or undulated, sometimes distinctly notched in the margin, free or adhering on the columellar side and sometimes expanded and presenting a thickened callosity or columellar lip.

Surface marked by fine undulating striæ of growth, which sometimes become lamellose. In well-preserved specimens, finer revolving striæ cancellate the striæ of growth, and sometimes the surface is marked by revolving ridges.

The principal varieties of form and mode of growth are illustrated on plates 28 and 29. The large collections present numerous intermediate forms and varieties of surface-marking.

PLATYOSTOMA PLEBEIUM.

Plate 28, Figs. 14, 15.

Platyostoma plebia HALL. Doc. Edit. 28th Rep. St. Mus. Nat. Hist. Explanation of pl. 28, figs. 14, 15. 1876.

Shell dextral, conical; volutions four, very convex, gradu-

ally increasing in size from the apex, the last volution free for a short distance above the aperture, the back sometimes flattened; aperture broadly elliptical, opening nearly parallel to the axis of the shell, without proper umbilicus; suture-line deeply impressed leaving more than three-fourths of the height of the volution exposed.

Surface marked by fine transverse striæ of growth, which are usually quite regular, but sometimes abruptly arching forward on the middle of the last volution, and receding above and below, in conformity to sinuosities in the lip.

This species is distinguished from *P. Niagarense* by the more elevated spire, and by the form and relative position of the aperture. The surface-markings are also usually finer than in that species.

STROPHOSTYLUS *Hall.*

STROPHOSTYLUS CYCLOSTOMUS.

Plate 30, Figs. 1-13.

Strophostylus cyclostomus HALL. Trans. Alb. Inst., vol. iv, p. 218. Abstract p. 24; May, 1863.

Shell subglobose or transversely broad oval. Spire moderately elevated; volutions about four, rounded, the last one extremely ventricose and very much extended on the upper side and at the sutural margin. Aperture circular or subcircular, very oblique to the axis; peristome thin, entire, without sinus or emargination, spreading over the surface of the next volution, rarely leaving a slight umbilicus. Columellar lip grooved in the lower part, with a rather strong spiral fold at about one-third the diameter from the lower side of the aperture. Suture not canaliculate.

Surface marked by strong, crowded lamellose striæ of growth parallel to the margin of the aperture, and by much finer revolving, undulating lines, producing a finely cancellate structure in well-preserved specimens.

This species, in the elevation of the spire, differs from any other described form of the genus, except *S. elegans* of the Lower Helderberg, and from that one in being more ventricose and more oblique.

STROPHOSTYLUS CYCLOSTOMUS var. DISJUNCTUS *n. var.*

Plate 30, Figs. 14 and 15.

Strophostylus cyclostomus? HALL. Doc. Edit. 28th Rep. St. Mus. Nat. Hist. Explanation of pl. 30, figs. 14, 15. 1876.

The earlier volutions of this fossil have the characters of form and surface-markings of *S. cyclostomus;* but the last volution is less expanded, and becomes entirely disjoined toward the aperture, preserving no evidence of columellar lip or thickening of the peristome.

The surface-markings are characteristic of the genus.

BELLEROPHON *Montfort.*

BELLEROPHON TUBER.

Plate 30, Figs. 19, 20.

Bellerophon tuber HALL. Doc. Edit. 28th Rep. St. Mus. Nat. Hist. Explanation of pl. 30, figs. 19, 20. 1876.

Shell convolute, subglobose, height and width about equal. Aperture expanded, broadly reniform, bilobate, with a broad sinus on the dorsal margin. Dorsum subcarinate toward the aperture.

Surface marked by fine striæ parallel to the lines of growth, commencing at the umbilicus and curving broadly over the side of the shell, and somewhat abruptly recurved on the dorsum.

This species is the only Bellerophon proper which has come under my observation from the Niagara group. The specimens of this species from Waldron are very imperfect, all of them having been macerated, and usually deprived of the shell. The example figured is less expanded than some others, from later collections, which are likewise distinctly carinate on the dorsum near the aperture.

CYRTOLITES *Conrad.*

CYRTOLITES SINUOSUS.

Plate 30, Figs. 16-18.

Cyrtolites sinuosus HALL. Doc. Edit. 28th Rep. St. Mus. Nat. Hist. Explanation of pl. 30, figs. 16-18. 1876.

Shell convolute, volutions in the same plane, contiguous. Body of the shell strongly lobed, the dorsum being separated from the lateral portions of the shell by a distinct groove or sinus on each side. Aperture elongate, subquadrate, auriculate at the sides, and the peristome deeply sinuated in front.

The specimens of this species are casts of the interior, and the surface-markings are unknown. This form may be compared with *Bucania trilobata*, of the Medina Sandstone and Clinton group, but it is less gibbous, more abruptly trilobate, and is marked by a deep abrupt sinus in the anterior margin of the peristome—a feature not known in that species.

CEPHALOPODA.

ORTHOCERAS *Breyn.*

ORTHOCERAS SIMULATOR.

Plate 27, Figs. 11, 12.

Orthoceras simulator HALL. Doc. Edit. 28th Rep. St. Mus. Nat. Hist. Explanation of pl. 27, figs. 11, 12. 1876.

Shell cylindrical, gradually enlarging, siphuncle subcentral; septa distant from each other about one-fourth of the diameter of the shell — from three to four in the space of 14 millimetres.

Surface finely striated transversely.

The diameter of the largest specimen observed is 25 millimetres.

The specimens are frequently flattened and in very bad condition, the shell being entirely destroyed, and usually the septa are obliterated.

TROCHOCERAS *Barrande Hall.*

TROCHOCERAS WALDRONENSE.

Plate 27, Figs. 13-15.

Trochoceras Waldronensis HALL. Doc. Edit. 28th Rep. St. Mus. Nat. Hist. Explanation of pl. 27, figs. 13–15. 1876.

Shell dextral, making about two volutions; spire depressed, volutions slightly flattened; section subelliptical; gradually expanding, and the outer chamber continued in a more direct line; siphuncle excentric, nearer to the concave dorsal margin; septa moderately convex.

Surface marked by strong annulations, which are oblique and abruptly curved backward on the convexo-ventral side, very gradually increasing in distance from each other, to the

outer chambers, beyond which the shell is marked by gentle undulations or lines of growth; the space between the annulations regularly concave. In well-preserved specimens (seldom in others) there are finer surface-markings consisting of longitudinal striæ of which there are five in the space of one millimetre; these are crossed by finer concentric striæ.

This species differs from any known form in the Niagara group, by its more slender and gradually enlarging volutions.

ANNELIDA.

SPIRORBIS *Lamarck.*

SPIRORBIS INORNATUS.

Plate 31, Figs. 14, 15.

Spirorbis inornatus HALL. Trans. Alb. Inst., vol. iv, p. 224. Abstract, p. 30; May, 1863; including *Spirorbis ? flexuosus* HALL. Trans. Alb. Inst., vol. iv, p. 224. Abstract, p. 30; May, 1863.

Convolute, discoid, adhering, deeply depressed or umbilicate, consisting of about two volutions, the outer one robust, transverse diameter the greater, margin subangular.

Surface smooth or with lines of growth which on the exposed edge of the volution sometimes become slight ridges.

The specimens of this species are comparatively numerous, but the greater part are without distinctive surface-markings, or incomplete in their volutions.

In a single specimen before me, the tube, after making about one volution and a half in contact, becomes free, assuming a sinuate or spiral direction, extending about two mm. from the point of divergence, and somewhat rapidly enlarging to the outer extremity, which is imperfect; in other respects this form has the character of *Spirorbis inornatus*. A similar feature has already been illustrated in *Spirorbis laxus* of the Lower Helderberg group (Pal. N. Y., vol. iii, page 349, plate 54, fig. 18).

The original specimens described as *Spirorbis ? flexuosus* are not now accessible, but it is presumed that they were similar to the one referred to, with the outer volution becoming free and continuing in a sinuate or direct line, and are probably not distinct from *S. inornatus*.

CORNULITES *Schlotheim.*

CONCHICOLITES *Nicholson.*
ORTONIA *Nicholson.*

CORNULITES PROPRIUS.

Plate 31, Figs. 1-13.

Cornulites proprius HALL. Doc. Edit. 28th Rep. St. Mus. Nat. Hist. Explanation of pl. 31, figs. 1-13. 1876.

Elongate-tubular, obconical or trumpet-shaped bodies, rapidly enlarging toward the aperture which is campanulate with the margins always imperfect. Surface in the young usually sharply annulated and longitudinally striated; the section subcircular, a little flattened on the adhering side.

These bodies in their young state are parasitic (adhering to other organic bodies), occurring as slender tubes which are more or less curved or undulating, and rarely straight for a considerable portion of their length; the apices, when entire, are abruptly curved, often making half a volution or more; growing singly or in groups of two or more (as shown in figures 1–3, pl. 31,) and conforming to the contour of the surface to which they are attached for a varying distance of 10 to 20 mm. or more, and then becoming free, either by extending in a direct line and rising above the surface, or growing beyond the limits of the object to which the germ was attached, and continuing their growth; or becoming separated, leave the adhering basal portion, which is always imperfect or broken at the margins of the open extremity.

This is the prevailing, and almost universal condition of these bodies in their earlier stages of growth. The minute apex finally becomes solid, is absorbed, or otherwise disappears; the remaining tubular portion gradually loses its evenly annulated character in the progress of growth, the substance of the tube becomes thickened, the rings broader, less defined or obsolescent, merging into a generally undulating or subimbricating surface, which is marked by numerous thin irregular annulating ridges, sharply crenulated by the longitudinal striæ. In this condition the lower or early portions of the fossil are rarely preserved, the lower extremity being usually broken or sometimes cicatrized, having become free from the original attachment and continuing as an independent body in the form of a straight, trumpet-shaped tube. Many of them, however, still adhere to the original surface

till they have acquired a large size (depending in some degree upon the nature and extent of the surface to which they are attached), as shown in fig. 5 of plate 31; the lower extremity has here become thickened, and the annulated character obsolete.

The annulations, so well defined in the younger stages of growth, affect the interior of the tube, which is enlarged at these points; and from the interannular spaces, there are thin lamellæ projecting into the interior, and for some distance across the cavity of the tube. In some phases of wearing or decortication, these lamellæ give a partially septate character to the fossil; and it is due to the same cause that we have the annulated casts of the interiors, where the sharp constrictions mark the place of these projecting lamellæ.* The same feature occurs in all the species, and where the small parasitic tubes become worn down they present a septate appearance.

In the young state, the annulations and the interior projecting lamellæ are alternate and corresponding in number; but as the exterior becomes thickened and its growth irregular, the interior continues essentially uniform, and the projecting lamellar septa maintain much regularity in their occurrence. The thickening of the walls, and the irregularity of growth, is confined to the exterior, while the cavity of habitation maintains a regularly increasing size, very rarely encroached upon by the cellular tissue.

The interior structure of the walls is vesicular, but these walls vary greatly in thickness in specimens externally of the same size, as may be seen by comparing figures 9 and 10 of plate 31. Even the smaller parasitic tubes, like those of figures 1, 2 and 3, show a vesicular wall structure, although this is often limited to one or two ranges of vesicles; and the same is sometimes true of the larger specimens, as shown in figure 10, and in figure 11, where the wall on one side is thin and nearly or entirely destitute of cellular tissue. This texture is not only variable in extent, but also in the form of the vesicles (as shown in figures 12 and 13), and it sometimes so far invades the interior wall as partially to obliterate the evidence of annulations, as in the specimen figure 13, where this cellular tissue has formed upon the inner face of the tube.

Since this fossil occurs in such different phases (the prevailing one of which is shown in figures 1–3, and another in figures 4–7,) the identity is not readily observed; but a study and comparison of a large number of specimens has left no doubt of their identity; the different forms being simply the dif-

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* Illustrations of this feature are given in Murchison's *Silurian System*, plate 26, where both the casts and the interior of the tube are shown. Also in *Pal. N. Y.*, vol. ii, plates 28 and 85 (this latter supplementary plate is erroneously numbered 83 in some of the copies), where casts and partial casts of a species are illustrated. In *Pal. N. Y.*, vol. i, page 92, I have mentioned the septate character of the tubes of a species which I had referred with doubt to Tentaculites.

ferent stages of growth of the animal, which in its young state is parasitic, becoming free above and rapidly increasing in size in its later stages.

This manifestation of development, here illustrated, corresponds in all respects with the figures given by Sir R. I. Murchison in his *Silurian System*, as cited in a previous note, except that we do not possess casts of the interior, which are there illustrated in a very beautiful manner. Similar casts of another species are illustrated on plate 28, figs. 12, a. c. d. e., Pal. N. Y., vol. ii. The Waldron specimens, in their young condition, closely resemble those from Dudley in England, as they occur attached to the shells of PENTAMERUS and MERISTELLA.

The similarity of CORNULITES, in its young state, with TENTACULITES, has led to the reference of these bodies to the latter genus, and in some of their phases it is not easy to make the distinction.* The Tentaculites in all stages of growth, so far as we know, have been free floating shells; but CORNULITES is always parasitic in its young state at least, and may either become free or remain attached throughout its existence. Some of the forms heretofore known as TENTACULITES in rocks of the Hudson River group in the western States, and possessing all the external characters of that genus, have also the vesicular texture belonging to CORNULITES; and a more critical study of some of the species has shown them to be parasitic and gregarious in their earlier stages of growth. I have long known that *Tentaculites flexuosus* (Pal. N. Y., vol. i,) is a CORNULITES, and these facts have induced me to review some other species published as TENTACULITES.

Tentaculites flexuosus, ut cit. will therefore be placed under CORNULITES = *C. flexuosus*, a species growing singly or in groups, as illustrated in the original figures, *Pal. N. Y.*, vol. i, pl. 29, and of which we know nothing regarding its later stages, corresponding to the larger growth of *C. proprius*.

The figure described in the same volume, page 284, pl. 78, is apparently a distinct species; and the specimens from western localities, considered identical with that from the Hudson river group of New York, have since been described under other names.

The form described as *Cornulites flexuosus* (*Pal. N. Y.*, vol. ii, p. 98, pl. 28,) is a true CORNULITES, the specimen 12a retaining a portion of the test, but preserving no distinct exterior annulations, while the other figures are casts of the interior. Since the specific name *flexuosus* is pre-occupied, I propose the name *Cornulites Clintoni*.

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* See illustrations *Pal. N. Y.*, vol. v, part ii, plate 115.

This species is allied to the *C. arcuatus* of Conrad, from the Niagara limestone of New York, in which the annulations of the cast are more rounded, and the shell more rapidly tapering.*

An examination of the original specimens of *T. distans*, of the Clinton group, proves it to be a CORNULITES, and it will therefore be indicated as *Cornulites distans.*

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* *Jour. Acad. Nat. Sci. Phil.*, vol. viii, p. 276, pl. 17, fig. 8.

CRUSTACEA.

LEPERDITIA *Rouault.*

LEPERDITIA FABA.

Plate 32, Figs. 1-3.

Leperditia faba HALL. Doc. Edit. 28th Rep. St. Mus. Nat. Hist. Explanation of pl. 32, figs. 1-3. 1876.

Form subovate, gibbous, greatest convexity just anterior to the middle ; hinge-line straight and equaling two-thirds the length of the shell ; width of the shell equal to three-fifths of the length ; valves subequal, the left valve the larger and overlapping at the base ; posterior end rounded, narrower than the anterior ; base broadly and regularly rounded in outline, the line of junction of the two valves being slightly arcuate laterally.

Surface apparently smooth.

BEYRICHIA *McCoy.*

BEYRICHIA GRANULOSA.

Plate 32, Fig. 4.

Beyrichia granulosa HALL. Doc. Edit. 28th Rep. St. Mus. Nat. Hist. Explanation of pl. 32, fig. 4. 1876.

Form broadly semioval ; dorsal side straight ; anterior and posterior lobe unequal ; the ventral, anterior and posterior sides bordered by a broad flattened rim ; subcentral node ovate, extending three-fifths the width of the test, and about one-fourth as wide as the length of the shell.

Surface finely tuberculate.

CALYMENE *Brongniart.*

CALYMENE NIAGARENSIS.

Plate 32, Figs. 8-15.

Calymene Niagarensis HALL. Geol. N. Y. Surv. 4th Geolog. Dist., p. 101, fig. 3, and p. 102. 1843.

Calymene Blumenbachii var. *Niagarensis* HALL. Pal. N. Y., vol. ii, p. 307, pl. 67, figs. 11 and 12. 1852.

Calymene Niagarensis HALL. 20th Rep. St. Cab. Nat. Hist., p. 400; Rev. Edit., p. 425. For synonymy of the species, see Pal. N. Y., vol. ii. p. 307.

This species is the most abundant form among the trilobites of the Waldron locality. The specimens present no modification of characters from those in the Niagara shale of New York, although they are usually of larger size. A large proportion of the individuals in the earlier collections, are fragmentary, having been macerated upon the sea bottom before they were covered by the sediments. In the collections recently made are several individuals which preserve all the parts entire.

This species is associated with CYPHASPIS, HOMALONOTUS, ILLÆNUS, LICHAS and DALMANITES.

HOMALONOTUS *Konig.*

HOMALONOTUS DELPHINOCEPHALUS (*Green*).

Plate 32, Figs. 17, 18.

Trimerus delphinocephalus GREEN. Monograph of Trilobites, p. 82, pl. 1, fig. 1. 1832. For synonymy and other references, see Pal. N. Y., vol. ii, p. 309.

This species occurs at the Waldron locality, mostly in a fragmentary condition. One specimen preserving the head and thorax nearly entire has been observed. Exclusive of this specimen, the species is only represented by fragments of the cephalic and caudal shields. These portions of the fossil bear all the characteristic marks of identity with those from the Niagara shale in New York.

CYPHASPIS *Burmeister.*

CYPHASPIS CHRISTYI.

Plate 32, Figs. 5-7.

Cyphaspis Christyi HALL. Trans. Alb. Inst., vol. iv, p. 220. Abstract, p. 26; May, 1863.

General form of body elongate-oval, the length nearly twice the greatest width of the thorax.

Head semioval, the posterior margin slightly concave, highly elevated in the middle, bounded by a proportionally strong thickened rim, the posterior angles being prolonged into slender spines reaching to the sixth or seventh thoracic segment, and slightly divergent. Glabella small, broad-ovate, rounded in front and truncate behind, about half the length of the head, greatest width anterior to the middle; surface convex, very prominent behind, some specimens showing faint indications of a pair of short oblique furrows anterior to the middle; near the base on each side a small ovate node separated from the glabella by a distinct furrow; longitudinal furrows moderately deep. Eyes small, very prominent and rounded, situated about one-third the length of the head from the posterior margin; distance from center to center equal to the length of the head forward of the occipital furrow; the surface smooth. Occipital ring narrow, the furrow well marked, becoming less distinct toward the posterior cheek furrows. Cheeks not prominent except anteriorly.

Thorax with twelve segments, highly convex, deeply lobed, lobes nearly equal in the anterior portion; the axial lobe more rapidly tapering posteriorly than the lateral ones, its annulations curved forward in the middle; lateral segments curved a little backward, the extremities obtusely rounded, somewhat abruptly bent a little nearer the axial extremity, causing an angular ridge along each lateral lobe; each segment marked by a strong longitudinal furrow nearer the anterior margin.

Pygidium small, subsemicircular, a little arched forward on the anterior border; axial lobe extending a little more than two-thirds the length of the pygidium, rounded at the extremity and marked by one distinct and one indistinct annulation,

as also in the lateral lobes. Surface marked by small scattered pustules, most distinct on the cheeks and segments of the axial lobe.

Length of an ordinary specimen 17 mm.; greatest width of thorax a little more than 8 mm.; length of head, 6 mm.; length of pygidium 2 mm.

This species differs from all others described, in the elongate form of the head and in the proportions of the body.

ILLÆNUS *Dalman.*

ILLÆNUS ARMATUS?

Plate 32, Figs. 19, 20.

Illænus armatus HALL. 20th Rept. St. Cab. Nat. Hist., p. 320, pl. 22, figs. 1-3. 1867. Rev. Edit., pp. 418, 433. [1870.]
Illænus Barriensis [MURCH.] HALL. Trans. Alb. Inst., vol. iv, p. 227. Abstract, p. 33; May, 1863.

The specimens of ILLÆNUS occurring in this locality are all fragmentary, and so imperfect that no satisfactory identification can be made. The form of the pygidium is like *I. armatus.* The head is more extended in front than in that species from Wisconsin, but this may be due in some degree to the compression which has flattened the specimens. One specimen retaining the movable cheek, with its posterior extension, has been observed, leaving little doubt as to the identity of the species.

CERAURUS *Green.*

CHEIRURUS *Beyrich.*

CERAURUS (CHEIRURUS) NIAGARENSIS.

Plate 32, Fig. 16.

Compare *Cheirurus insignis* BEYRICH. Ub. Bohm. Tril., p. 12, fig. 1.
Compare *Cheirurus insignis* BARRANDE. Syst. Sil. Cent. Bohême, p. 782, pl. 41.
Compare *Cheirurus insignis* CORDA. Prod., p 133, pl. vi, fig. 70.
Ceraurus insignis HALL. Pal. N. Y., vol. ii, pp. 300, 306, pl. 67, figs. 9, 10. 1852.
Ceraurus insignis HALL. 20th Rep. St. Cab. Nat. Hist., p. 335. 1867.
Ceraurus Niagarensis HALL. 20th Rep. St. Cab. Nat. Hist., Rev. Edit., p. 427, pl. 21, figs. 10, 11. [1870.]
Sphærexochus Romingeri? HALL. Doc. Edit. 28th Rep. St. Mus. Nat. Hist. Explanation of pl. 32, fig. 16. (Erroneous reference.)

Ceraurus bimucronatus ? (MURCHISON) ROEMER. Silur. Fauna Westl. Tenn., S. 80, T. V. fig. 19; not *Cheirurus bimucronatus* MURCHISON. Siluria Foss. 64; fig. 4, pl. 3, fig. 5; and pl. 19, figs. 10, 11.

Compare *Cheirurus pauper* BARRANDE. Syst. Sil. Cent. Bohême, p. 800, pl. 41, fig. 41.

Compare *Cheirurus obtusatus* (CORDA) BARRANDE. Syst. Sil. Cent. Bohême, p. 786, pl. 41, figs. 14-16.

This species, so far as known, is only represented by fragments of the cephalic shields found in New York, Wisconsin, Tennessee and Indiana, and nearly perfect specimens of the pygidia, also found at Waldron, Indiana. With the material now at hand, a more exact and satisfactory comparison can be made with various European species.

The only European species with a single obtuse node at the extremity of the pygidium are *C. insignis* BEYRICH, *C. pauper* BARR., and *C. obtusatus* CORDA; the other allied species have the extremity variously mucronate or emarginate. These species also all agree in the comparatively slender sharp spines on the lateral margins.

The pygidia found at Waldron may be described as follows:

Pygidium longitudinally subelliptical, very slightly convex, axis prominent in front, diminishing very rapidly in size and elevation toward the posterior end, composed of three prominent annulations, and a flat, rounded node extending beyond the margin, with two small circular depressions at the base near the third segment, probably indicating a rudimentary fourth segment. Lateral lobes composed of three pairs of segments, having a very short, deep furrow at the base of each segment; produced into three broad, flat, subtriangular curved spines, notched at the base on the anterior margin, extending outward and curving abruptly backward, concave to the axis. Surface granulose.

Surface of the glabella covered with small crateriform pustules. The fixed cheek is finely granulose, with small, irregular circular depressions.

From the above it will be seen that the separation first made in the revised edition of the 20th Rept. St. Cab., was necessary, and that it constitutes a distinct species.

NOTE ON THE GENUS DALMANITES AND ODONTOCEPHALUS.

CRYPHÆUS *Green.* 1837.
ODONTOCEPHALUS *Conrad.* 1840.
DALMANIA and DALMANITES *Emmrich.* 1845.
ODONTOCHILE *Corda.* 1847.*

The genus DALMANIA or DALMANITES of Emmrich has been generally adopted by European and American authors, overlooking the fact that Green, in 1837, proposed the name CRYPHÆUS, and Conrad, in 1840, proposed the name ODONTOCEPHALUS for forms now included under Emmrich's genus The typical species of Conrad's genus was the *Asaphus selen urus* of Eaton, described in 1832.

In 1835, Green, in the supplement to his *Monograph of the North American Trilobites*, described the head of a Trilobite under the name of *Calymene odontocephala*,† from the denticulate character of the anterior margin of the buckler or cephalic shield. This species of Green was identified among the collections from the upper limestones of the Helderberg and Schoharie, and in 1840 Mr. Conrad discovered an entire specimen which had been collected at Auburn, N. Y. This specimen proved that the *Asaphus selenurus*, Eaton, of which only the caudal shield had been heretofore known, and *Calymene odontocephala* of Green, described from the head alone, were one and the same species, and he proposed the generic name of ODONTOCEPHALUS, and *Odontocephalus selenurus* as the typical species.‡

The name ODONTOCEPHALUS has, therefore, priority over DALMANIA by five years in time, and while, although naturalists would prefer to retain the use of the name Dalmania or Dalmanites, (the former being also used for a genus of dipterous insects,) it becomes a question whether a just interpretation of the rule of priority would not require the adoption of the name ODONTOCEPHALUS. While aware of the fact that Mr. Conrad had thus described the *Asaphus selenurus* of Eaton, the writer has in former publications adopted the name Dalmania or Dalmanites, without considering the question of dates.

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* The generic name CRYPHÆUS, proposed by Green in 1837, was already preoccupied for a genus of Coleoptera in 1833, and the name ODONTOCHILE had also been given to a genus of Coleopterous insects in 1834.

† Cast No. 36 of Green's series of casts of Trilobites.

‡ Third An. Report Pal. Dept. N. Y. Geol. Survey. 1840.

The distinguishing features of the genus CRYPHÆUS of Green (1837), are, according to its author, the fimbriate caudal shield, of which he remarks: "The second series of ribs, which proceed beyond the costal arches of the Cryphæus, we suppose will distinguish it from every other described genus." He remarks that "a very slight obliteration" of these parts "would give them all the characters of a Calymene" = Phacops.

In considering the question of generic identity, however, it should not be forgotten that the typical forms of the genus DALMANITES, which are similar to the Niagara and lower Helderberg species, have never shown the denticulated anterior border or fimbriated pygidium. The genus was originally characterized as having many annulations in the axis of the pygidium, but farther investigation has included forms with few annulations. The ODONTOCEPHALUS, in its typical form, is characterized by the denticulate border and a pygidium with few annulations in the axis. Similar characteristics mark the other allied species, so far as known.

Whatever may be the real value or importance of these structural modifications, it is interesting to find their manifestation coincident with the change or succession of the geological formations. The lowest forms, geologically, have simple phacopidean heads — (the posterior angles not produced) with pygidia which are acute or subacute posteriorly and have numerous annulations in the axis. In the next phase these forms of the group have the posterior angles of the buckler prolonged into spinform extensions, and the caudal extremity very acute or extended into a more or less elongate spine. A still farther modification occurs in the next horizon where the posterior angles of the buckler are extremely prolonged, the caudal extremity extended into a long spine, and the anterior border of the head produced into a simple or bifurcate, or sometimes tridentate process. In the next geological period, we find the forms of this group having the posterior angles of the buckler either moderately or extremely prolonged, the caudal extremity truncate or emarginate (concave) and produced on each side posteriorly into a short spine (or sometimes with an accessary spine), on each side, and the extremities of the caudal ribs spiniferous. The anterior margin of the buckler is rounded or slightly produced and denticulate, either in the front alone or upon the entire border.

In the next stage the anterior margin of the buckler is rounded and simple, the posterior angles more or less prolonged into spiniform extensions, and the caudal extremity fimbriate with rounded or more or less flattened spiniform processes; of these there are five on each side of the axial extremity, which is likewise produced into a short flattened spine.

These extravagant forms of DALMANITES or ODONTOCEPHALUS, in the last two geological stages, are associated with the staid and almost unvarying PHACOPS which begins and ends its existence in the three latest named geological periods. * * *

For the present I propose to recognize the following species as DALMANITES, until it shall be determined whether the forms possessing the characters of the genus ODONTOCEPHALUS may be properly distinguishable as a separate group.

DALMANITES VIGILANS.

Plate 33, Figs. 1-4.

Dalmanites vigilans HALL. Rep. Prog. Geol. Surv. Wis., p. 57. 1861.
Dalmania vigilans HALL. 20th Rep. St. Cab. Nat. Hist., p. 335, pl. 21, figs. 16-18. Rev. Edit., p. 426.
Dalmania vigilans HALL. Doc. Edit. 28th Rep. St. Mus. Nat. Hist. Explanation of pl. 33, figs. 1-4. 1876.

General form of body broadly ovate, greatest breadth across the posterior part of the cephalic shield.

Head convex, semi-elliptical, breadth about twice as great as the length (exclusive of the frontal projection); border extended in front into a triangular, sometimes truncate, process, the base of which is little less than one-half as wide as the width of the anterior portion of the glabella; in older individuals this projection becomes more obtuse and sometimes rounded; lateral borders broad, flattened, separated from the cheeks by a distinct groove, produced posteriorly into long, slender parallel spines, which do not extend beyond the general outline, and are continued as far as the extremities of the fifth thoracic segment. Glabella large, depressed-convex, widening in front to twice its width at the posterior margin, divided into lobes by three pairs of transverse furrows exclusive of the occipital furrow, which is distinct and continuous; the two posterior furrows distinct at the sides, but not extending entirely across the glabella except in a faint depression; the anterior furrows deep, very distinct, situated a little anterior to the eyes, extending each about one-third across the glabella and giving to the frontal lobe a transversely elliptical outline; occipital ring narrow, ornamented in the middle by a single, short, sharp spine. Eyes very prominent, short reniform, containing about thirty-five vertical ranges of lenses,

the middle ranges having nine each. Palpebral lobe depressed, giving great prominence to the rim of the eye. Cheeks small, prominent on the anterior portion, marked near the posterior border by a deep groove—the continuation of the occipital furrow; margin broad and flat.

Thorax with the axial lobe depressed-convex, widest at the sixth segment, its greatest width more than two-thirds that of the lateral lobe. The articulations curve forward in the middle and at their junction with the lateral lobes, near the extremities they are bent suddenly backward, terminating in a sharp point. Articulations of the lateral lobes traversed by a deep longitudinal furrow extending from the middle lobe to the abrupt curve near their extremities.

Pygidium somewhat elongate-triangular, extended posteriorly into an acute spine; central lobe or axis marked by ten or twelve narrow annulations; the lateral lobes less prominently marked by ten flattened ribs, which are traversed by a deep furrow, and terminate in a narrow border; the two posterior pairs of ribs are directed obliquely backward.

Surface of the head, except the anterior and lateral border, covered with small irregular pustules, the border being finely granulose. The remainder of the body is granulose, with occasionally small pustules on the axial lobe of the thorax.

The Waldron specimens of this species were identified with specimens from Wisconsin, which formed the basis of the original description. The only important differences noticed, are the lesser prolongation of the anterior process; the head is not so regularly semi-elliptical, but is more angular on the posterior side; the pygidium is somewhat more elongate and more acutely terminated. The species was originally described from specimens of the buckler and pygidia. In the recent collections from Waldron, there are several specimens retaining the thorax nearly entire, and from these the description of the species has been completed.

Compared with *D. verrucosus*, the head is proportionally narrower, the postero-lateral spines longer and less diverging; the pygidium is narrower and more elongate, and the surface is not so strongly covered with pustules. It somewhat resembles *D. limulurus* of the Niagara formation of New York, but differs in the proportionally larger glabella, the larger and more prominent eyes, and the extension of the anterior border.

Specimens of this form have proved comparatively rare in the collections thus far made at Waldron.

DALMANITES VERRUCOSUS.

Plate 33, Figs. 5-17; Pl. 34, Figs. 13-15.

Dalmania verrucosa HALL. Trans. Alb. Inst., vol. iv, p. 218. Abstract, p. 24; May, 1863.

General form elongate-ovate, the greatest breadth across the posterior part of the cephalic shield.

Head semicircular, or, including the lateral spines which reach to the base of the fifth thoracic segment, broad crescentiform, the anterior margin produced in front of the glabella, forming a semicircular projecting border about one-seventh as wide as the greatest width of the glabella. Glabella convex, not very prominent, the greatest breadth about equal to the length forward of the occipital furrow. Anterior lobe transversely oval, about twice as wide as the posterior lobe, separated from the rest by a pair of rather deep, obliquely transverse furrows, which extend about four-fifths across the glabella. Posterior and middle furrows short, but deeply marked, not extending to the margins of the glabella. Occipital furrow narrow and shallow, more deeply marked in its continuation in the cheek furrows. Eyes large, prominent, having in their greatest elevation, nine or ten ranges of lenses, and thirty-five ranges in the other direction. Palpebral lobe depressed, giving great prominence to the rim of the eye. Lobes of the cheeks rather prominent: marginal rim broad, the lateral portions having a rounded, undefined ridge near the inner border.

Thorax with the axial lobe depressed-convex, widest at the fourth and fifth segments, its greatest width not exceeding two-thirds that of the lateral lobe; the articulations curve forward in the middle and at their junction with the lateral lobes; articulations of the lateral lobes marked by a deep longitudinal furrow which commences at the juncture of the anterior margin with the axial lobe, and is directed backward, leaving the lower portion of the articulation about one-third of the whole width at the middle of the length, and again runs out on the upper margin, at the point where the articulation is bent abruptly backward.

Pygidium broadly triangular, the anterior lateral angles rounded and the lateral borders convex; axial lobe regularly tapering posteriorly, marked by thirteen annulations which

gradually decrease in size posteriorly, and terminate in a slender spine about half as long as the caudal plate. The lateral lobe has ten articulations, eight of which are divided by a longitudinal furrow; the last two are simple, and all become obsolete just within the margin.

Surface of the head, except the anterior and lateral borders, covered with small, somewhat pointed pustules, the border having only a finely granulose texture. Occipital and axial rings of the thorax and pygidium each marked with seven small spiniform pustules, the central one the longest; those of the pygidium become closely crowded in the posterior portion; there are sometimes two or more additional smaller pustules on the stronger rings of the thorax.

Length of a medium-sized specimen (exclusive of the caudal spine) 80 mm.; greatest width of the head somewhat more than 50 mm.; length of the head from the occipital ring 15 mm.; greatest width of thorax 48 mm.; width of axial lobe 13 mm.; length of pygidium (exclusive of the spine) 28 mm.; greatest width of pygidium 48 mm. Some of the large cephalic shields have a width of from 80 to 100 mm.

The heads of this species, in a tolerably good state of preservation, are very common; the remainder of the body being mostly found in a fragmentary condition.

DALMANITES BICORNIS.

Plate 33, Fig. 18.

Dalmania bicornis HALL. Doc. Edit. 28th Rept. St. Mus. Nat. Hist. Explanation of pl. 33, fig. 18. 1876.

This species is indicated from the occurrence of an incomplete border of the buckler, which preserves a strong bifurcatory anterior process — a feature sufficiently characteristic to distinguish it from any trilobite of the Niagara formation yet known to us. The form bears much general resemblance to *D. nasutus* of the Lower Helderberg formation, which has a much larger bifurcating anterior process, and in which the anterior lobe of the glabella is projected forward beyond the line of general contour of the cephalic shield.

LICHAS *Dalman.*

LICHAS BREVICEPS.

Plate 34, Figs. 1-7.

Lichas breviceps HALL. Trans. Alb. Inst., vol. iv, p. 222. Abstract, p. 28; May, 1863.
Not *Lichas breviceps* ? HALL. 20th Rep. St. Cab. Nat. Hist., pp. 334, 377, pl. 21, figs. 12-14. Rev. Edit., p. 424.

Head broad and short, somewhat crescentiform, projecting in front and prominent in the middle, the length about one-third as great as the width, posterior angles directed backward in short obtuse spines. Glabella very convex, wider than long, rounded in front, distinctly divided into three lobes, two lateral and one central, the central lobe narrower behind and rapidly expanding in front, the lateral lobes reniform and about as wide as the posterior part of the central or anterior lobe, commencing forward of the eye and reaching to the occipital furrow. Eyes very prominent, reniform, very convex on the visual surface, having the appearacce of the eyes in ILLÆNUS. Anterior border of the head very narrow in front of the glabella, being only a rounded rim. Cheeks flat or slightly concave, with a prominently rounded ridge just beneath the eye. Occipital ring prominent; furrow deep, becoming very faint in its extension into the cheek furrows. Surface of the head marked by fine scabrous pustules.

A portion of the thorax connected with a pygidium preserves the remains of ten articulations, in one of the lateral lobes and on a part of the axial lobe. The axial lobe is wider in the middle than at its junction with the head, and from the seventh articulation gradually tapers to the pygidium. The lateral lobe is a little more than two-thirds as wide as the axial lobe in its greatest width; the articulations are somewhat abruptly turned backward toward their extremities, which are closely arranged and in contact, except the last one, between which and the first segment of the pygidium is a narrow free space.

The separated pygidia present the following characters: General form semi-elliptical, a little rounded on the anterior border; axial lobe broad and strong, very prominent in the anterior part, rapidly narrowing and becoming low in the

middle and again widening posteriorly; its width at the anterior margin being about one-third as great as the whole width of the tail; a single anterior annulation. Lateral lobe with three segments on each side, and each marked by a broad, shallow, longitudinal furrow; at the posterior side of the two anterior ones, the margin of the shield is slightly indented, below this it is entire, with a regularly curved outline; the two anterior segments are curved a little backward and their extremities free, while the third one is curved first outward and then downward, uniting with the depressed axial lobe. The enfolding of the crust on the lower side extends upward about three-fifths of the length of the tail, and is strongly but distantly lamellose-striate.

Exterior surface marked by pustules of moderate size, and a few short hollow spines.

It resembles *L.* (*Platynotus*) *Trentonensis* as recognized in the blue shales of the Hudson river group of Cincinnati, in the prominent eyes; but the head is much shorter in proportion to its width, and the tail is broader and more nearly straight on the anterior margin.

LICHAS BOLTONI (*Bigsby*) var. OCCIDENTALIS.

Plate 34, Figs. 8-11.

Lichas Boltoni var. *occidentalis* HALL. Trans. Alb. Inst., vol. iv, p. 223. Abstract, p. 29; May, 1863.
For citations, see Pal. N. Y., vol. ii, p. 311. 1852.

This form is known almost entirely from the pygidia, most of the specimens being in an imperfect condition. The middle lobe of the pygidium is short and the articulations are more prolonged than in the usual forms of *L. Boltoni* in the Niagara shales of New York. This character, however, is subject to some variation, even among collections from the same locality, as may be seen by comparing the figure on plate 69 with 1g on plate 70 of vol. ii, Pal. N. Y.

A specimen of the right cheek indicates that the head was longer and more curved on the posterior margin.

In some of the New York specimens, the anterior border in front of the glabella is produced into a broad subnasute extension, and a single fragment, of what appears to be a similar but more extreme anterior prolongation of the head, has been found at Waldron (figure 12 of plate 34). Should this be

proved to belong to the form represented in figures 8, 9 and 10, the difference between the New York and western specimens would be still more marked. The individuals reached a large size, as is shown by a fragment of one of the thoracic segments, having a width of nearly 120 mm.

LICHAS —— *sp.?*

Plate 34, Fig. 12.

The fragment figured is apparently the frontal extension of the border of the glabella of a species of Lichas, corresponding to what is shown in figure 1a of plate 70, vol. ii, Pal. N. Y. It is probable that this belongs to the form of which the pygidia are represented in figures 8, 9 and 10, of the same plate.

LICHAS EMARGINATUS *n. sp.*

Lichas breviceps? HALL. 20th Rep. St. Cab. Nat. Hist., p. 334, pl. 21, figs. 12-14. 1867. Rev. Edit., p. 424. [1870.]

A comparison of this form with *L. breviceps* shows that the lateral lobes of the glabella are larger, and the eye tubercle smaller. The axial lobe of the pygidium is more prominent and longer, marked by four annulations in the anterior portion, and is gradually narrowed posteriorly, having a distinct conical form, with no expansion into the posterior border as in *L. breviceps*. The lateral lobes have the articulations more prolonged and bent more directly backward. The pygidium is also emarginate behind, while in *L. breviceps* from Waldron it is continuous.

It becomes necessary, therefore, to propose a name for the Wisconsin specimens which have been referred to *L. breviceps?*.

This species may be compared with *L. scabra* of Beyrich, and *L. avis* of Barrande, but the lateral articulations of the pygidium are much shorter in this species.

INDEX

TO THE

FAUNA OF THE NIAGARA GROUP.

NOTICE OF SOME REMARKABLE CRINOIDAL FORMS

FROM THE LOWER HELDERBERG GROUP.

By JAMES HALL.

In addition to several aberrant forms of Crinoidea, for which genera have been constituted, the species here noticed furnish some information as to the extreme variations which these organisms can assume in their mode of life, and in the special modifications of parts of their organism. The genera EDRIOCRINUS, ANCYROCRINUS and LICHENOCRINUS, depart in their habits, and in some degree in their structure, from the ordinary forms of the group, but with the exception of ANCYROCRINUS, they bear slight relation to the species of the present paper.

The specimens from the Tentaculite limestone in Schoharie, N. Y., were purchased with the Gebhard collection in 1872, and have remained unpublished in the hope of arriving at a more satisfactory determination of the nature of this remarkable form. During the past summer, Prof. James M. Safford, of Nashville, Tennessee, kindly placed at my disposal numerous specimens of an identical nature from the same horizon in Tennessee, and on this material, together with the New York specimens in the State Museum, the generic characters with the following descriptions of the species are based.

CAMAROCRINUS *nov. gen.*

Body large, externally lobed, chambered within, varying from transversely or longitudinally oblate-spheroidal to subspherical, and frequently assuming an unsymmetrical form from the unequal development of the lobes corresponding to the internal chambers. The cavity of the body or dome is divided into two or more large compartments, with usually several smaller accessory chambers, by vertical and horizontal partitions which are extensions of the substance of the inner walls of the dome.

The basal portion occupies a subcircular area, which is placed in a central position with regard to the disposition of the lobes of the body, and is surrounded by an elevated pro-

jection or extension of the walls. In structure this area is composed of spreading, radiciform, bifurcating rays, connected by irregular polygonal plates. The basal rays are composed of joints similar to those of an ordinary crinoidal column, and vary in number from five to twelve or more, and are arranged symmetrically with respect to two axes at right angles; they bifurcate at the third or fourth segment from their origin, and enclose ambulacral openings which penetrate into the interior cavities of the body.

The external wall of the dome is composed of two distinct layers, of which the infolding and extension of the inner one forms the partitions dividing the chambers. No traces of free arms have been observed. Column cylindrical, smooth near the body; the segments regular. The interior canal is five-lobed, and is divided and continued through the basal rays and their ramifications; not opening into any interior cavity of the body, so far as observed.

This remarkable crinoidal body is so totally unlike any previously described form, within my knowledge, that its true characters and relations are not at once evident. There is no doubt as to its crinoidal nature, but there is no apparent analogy of its parts with ordinary crinoids. Some of its characters would indicate that it is a curiously modified and enlarged summit or dome: that the visceral cavity is a small internal chamber immediately over the column-attachment; and that the lobes are an abnormal development of the interbrachial or interradial spaces. But the more probable theory in regard to this fossil, points to a functional similarity with a crinoidal root, as in ANCYROCRINUS from the upper Helderberg and Hamilton groups, in which there is a bulbous growth at one extremity of the column, supposed to act as a float or anchor to the body and arms. Viewing it in this respect, it may be regarded as a large chambered bulb, with an attached column, on the distal extremity of which was a calyx, having characters unknown at the present time. In this aspect, it must have been a free floating organism, similar in its habits to the recent *Medusæ* and *Comatulæ*. The lack of definition and symmetry which these crinoidal bodies assume would be an argument in support of this view, and find an explanation in their consequent secondary functional importance, and separation from the governing center or centers.

CAMAROCRINUS STELLATUS *n. sp.*

Plate 35, figs. 1-8.

Body oblate-spheroidal, convex above, flattened or somewhat concave below, with from three to twelve low, rounded lobes on the basal margin.

The base is composed of spreading radiciform, bifurcating branches, connected by a stellate network of finer ramifications, forming the plates of the base; the whole being surrounded by an irregular projected margin, and occupying an area having a diameter equal to from one-half to two-thirds the transverse diameter of the body. The basal branches, of which there are usually about eight, bifurcate at the third segment from their origin, and surround large ambulacral openings into the interior cavities of the body. The section represented in fig. 5, pl. 35, shows some evidences of a conical cavity above the center of the base, and a large horizontal septum, extending parallel to the base and at a distance above it, equal to the height of the internal conical chamber; but this does not appear to be a constant character.

The body is divided into four or more large chambers, or compartments, by radiating partitions from a central vertical axis. Near the summit, at the base and along the sides, there are frequently several accessory chambers formed by a division and divergence of the primary septa.

The external wall of the lateral and upper portions is composed of two layers of large and small stellate plates, connected by numerous processes. Each star is marked by a central rounded node, and the rays vary in number from three to ten. Column smooth, round near its attachment.

The largest specimen of this species observed, has a transverse diameter of 110 mm. with a vertical diameter of nearly 60 mm. The basal branches of the same specimen occupy an area having a diameter of 50 mm., or nearly one-half the transverse diameter of the body. In a smaller specimen whose transverse diameter is 55 mm. the basal area measures 28 mm., or nearly the same proportions as in the larger specimen.

This species is distinguished from *C. Saffordi* by its more depressed form, comparatively larger basal area, more numerous ambulacra, and in the stellate structure of the external walls. In some of its features it more nearly resembles *C. Clarkii*, but the unsymmetrical form of that species, the

numerous unequal internal chambers with correspondingly numerous ambulacra, are distinctive.

The external aspect of the specimens is similar to that of a Favosite or Sponge; and it is is only under favorable conditions of weathering that the true stellate structure of the external walls is exhibited.

Formation and locality. In the Tentaculite limestone of the Lower Helderberg group, at Schoharie, N. Y.

CAMAROCRINUS SAFFORDI n. sp.

Plate 36, figs. 1—6; Plate 37, figs. 1, 2.

Body spherical to oblate-spheroidal, vertically or transversely compressed and externally lobed; presenting from three to five large lobes, corresponding to the internal chambers. There are usually five lobes, but often very unequally developed, giving an unsymmetrical form to the body.

Basal area small, well defined; limited by an extension of the walls, and occupying a space having a diameter of about one-third the transverse diameter of the dome. Basal rays strong, their subdivisions enclosing five distinct ambulacral openings into the internal chambers, and laterally connected by numerous small polygonal plates similar to those composing the walls of the body.

The dome is ordinarily divided, by vertical partitions, into five large unequal chambers, which are rarely of a uniform size, and often show great inequality. In some specimens one or more of the chambers are partially or completely atrophied from the enormous development of adjacent chambers, producing forms similar to fig. 3, pl. 36, and figs. 1, 2, pl. 37.

Internal and external walls of the dome composed of small polygonal plates, united by minutely undulating or serrated suture-lines. The external plates are well defined by the depressed suture-lines and often show a small node or central tubercle. As in the other forms here described, the walls readily separate into an inner and outer layer, and the interspaces have a porous or spongy structure.

The specimens present such a great range in size and form that the dimensions are not apparently of specific importance. The largest example observed, which is represented in section in fig. 2, pl. 37, has a greatest transverse diameter of about 145 mm. and shows five unequal internal chambers. The transverse diameters of specimens of ordinary size vary from 80 to to 110 mm.

It is not at once evident as to what constitutes the important specific differences of these fossils. The specimens referred to *C. stellatus* show a somewhat more depressed and symmetrical form, the basal area is comparatively larger, with more numerous ambulacra, and the ornamentation of the exterior walls of the dome is conspicuously different from *C. Saffordi*. In contrast with *C. Clarkii*, the species here described has a more regular form, with fewer internal chambers and corresponding ambulacra, and the basal area is considerably smaller.

The projecting margin around the basal area is broken and imperfect in all the specimens examined, and its original extent is not known; but whatever variation there may be in the form of the body, this area is well defined and distinctly limited, having a subcircular or unequally pentagonal outline. The substance of the dome is usually silicified, and this change has obscured the minute structure of the walls, which is preserved in but few of the specimens.

Fig. 1, pl. 36, represents the bases of two small columns besides the large central one, suggesting the idea that this hydrocyst furnished a float or support to a colony of individuals. In fig. 5, there is a cicatrice such as would be produced by the separation of a similar accessory column. The external resemblance of the specimens of this species to a Favosite is even more marked than in *C. stellatus*, and is well represented in fig. 4.

Formation and locality. In limestone referred to the Lower Helderberg group, Hardin county, Tennessee.

CAMAROCRINUS CLARKII *n. sp.*

Plate, 36, figs. 7, 8; Plate 37, fig. 3.

Body of an irregular ovoid form, marked by numerous unequal lobes corresponding to the internal chambers; base flattened.

Basal area large and well defined, having a diameter of somewhat less than one-half the transverse diameter of the dome. Rays numerous, connected by small polygonal plates; bifurcating near the periphery of the basal area and surrounding small ambulacra leading into the internal cavities.

The interior of the hydrocyst is divided by vertical, horizontal, and oblique partitions, into numerous unequal chambers, which are shown on the exterior as rounded lobes. Each of these chambers has an ambulacral opening in the basal area.

Walls composed of very small polygonal plates varying in diameter from .5 to one mm.; surface smooth, without special ornamentation.

The specimen described shows, on the exterior, eleven lobes, which present great variations in comparative volume. Its greatest vertical diameter is 40 mm., and its transverse diameters are 46 and 55 mm., respectively. The basal area is subcircular, and measures about 23 mm.

This form is distinguished from *C. Saffordi* with which it is associated, in its more irregular form, larger base, and more numerous ambulacra. In the comparative size of the basal area it more nearly corresponds to *C. stellatus*, but its form and the structure of the walls are very different. The specimen forming the basis of the description possesses features which are apparently of specific importance as above indicated, while showing the variation and want of a constant definition, which characterize these bodies.

The great inequality exhibited in the lobes may, in other specimens, produce a general form very unlike those described. The form of the body, and the size and disposition of the lobes seems to be the most inconstant feature of the three species here described.

Formation and locality. In the Lower Helderberg, limestone, Hardin county, Tennessee.

EXPLANATION OF PLATES.

EXPLANATION OF PLATE I.

AGARICUS (LEPIOTA) PUSILLOMYCES *Peck.*

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Fig. 1. Two plants of ordinary size.
Fig. 2. Vertical section of a pileus.
Fig. 3. Spores × 400.

TREMELLA MYCETOPHILA *Peck.*

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Fig. 4. Three plants of ordinary size growing on *Agaricus dryophilus.*

MONOTOSPORA BISEPTATA *Peck.*

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Fig. 5. A block of wood bearing a patch of plants.
Fig. 6. A plant bearing an immature spore × 400.
Fig. 7. A plant bearing a mature spore × 400.
Fig. 8. Detached spores × 400.

CLAVARIA GRACILLIMA *Peck.*

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Fig. 9. Two plants of ordinary size.

CLAVARIA PULCHRA *Peck.*

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Fig. 10. Two plants of ordinary size.

HELOTIUM PILEATUM *Peck.*

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Fig. 11. Piece of an herb stem bearing three plants of ordinary size
Fig. 12. A plant magnified.
Fig. 13. An ascus containing spores × 400.
Fig. 14. Spores × 400.

LENTINUS UMBILICATUS *Peck.*

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Fig. 15. A plant of ordinary size with the stem eccentric.
Fig. 16. A plant of ordinary size with the stem central.
Fig. 17. Vertical section of a pileus.
Fig. 18. Transverse section of a stem.
Fig. 19. Spores × 400.


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PLATE I — (*Continued*).

Hygrophorus parvulus *Peck.*

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Fig. 20. A plant of ordinary size.
Fig. 21. A larger plant, showing the lamellæ.
Fig. 22. Vertical section of a pileus.
Fig. 23. Transverse section of a stem.
Fig. 24. Spores × 400.

Stilbum candidum *Peck.*

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Fig. 25. Piece of a stem bearing four plants of ordinary size.
Fig. 26. A plant magnified.
Fig. 27. Spores × 400.

Haplographium apiculatum *Peck.*

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Fig. 28. A leaf with its fungus-bearing gall.
Fig. 29. The gall and its hairy coating of fungi slightly magnified.
Fig. 30. Upper part of a plant bearing strings of spores, magnified.
Fig. 31. Upper part of a plant deprived of its spores, × 400.
Fig. 32. A branched string of spores × 400.
Fig. 33. Separate spores × 400.

Discella discoidea *C. & P.*

Page 58.

Fig. 34. Piece of a branch bearing the fungus.
Fig. 35. A pustule and its mátrix magnified.
Fig. 36. A fertile filament bearing spores × 400.
Fig. 37. Spores × 400.

PLATE II.

ERYSIPHELLA AGGREGATA *Peck.*

Page 63.

Fig. 1. An alder catkin coated by the fungus.
Fig. 2. A conceptacle and its mycelium magnified.
Fig. 3. A sporangium containing spores × 400.

MICROSPHÆRA ABBREVIATA *Peck.*

Page 64.

Fig. 4. Part of the circumference of a conceptacle and two appendages × 400
Fig. 5. A sporangium containing spores × 400.

VENTURIA KALMIÆ *Peck.*

Page 82.

Fig. 6. A leaf bearing the fungus.
Fig. 7. A perithecium magnified.
Fig. 8. An ascus containing spores × 400.
Fig. 9. Spores × 400.

VALSA MUCRONATA *Peck.*

Page 74.

Fig. 10. Piece of a branch bearing the fungus.
Fig. 11. A single cluster of the fungus magnified.
Fig. 12. An ascus containing spores × 400.
Fig. 13. Spores × 400.

* SPHÆRIA AMPHICORNIS *Ellis.*

Page 78.

Fig. 14. Several perithecia attached to the matrix.
Fig. 15. A perithecium magnified.
Fig. 16. An ascus containing spores × 400.
Fig. 17. Spores × 400.

SPHÆRIA MIRABILIS *Peck.*

Page 80.

Fig. 18. Part of a leaf bearing the fungus.
Fig. 19. A perithecium magnified.
Fig. 20. An ascus containing spores × 400.
Fig. 21. Spores × 400.

* This name antedates *Sphæria eximia* as noted in the Thirty-first State Museum Report, page 60.


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PLATE II — (*Continued*).

VENTURIA CLINTONII *Peck.*

Page 82.

Fig. 22. Part of a leaf bearing the fungus.
Fig. 23. A perithecium magnified.
Fig. 24. An ascus containing spores × 400.
Fig. 25. Spores × 400.

VALSA OXYSPORA *Peck.*

Page 73.

Fig. 26. Piece of a branch bearing the fungus.
Fig. 27. A pustule with its matrix magnified.
Fig. 28. An ascus containing spores × 400.
Fig, 29, Spores × 400.

SPHÆRIA PHÆOSTROMOIDES *Peck.*

Page 77.

Fig. 30. Piece of a branch bearing the fungus.
Fig. 31. Two perithecia magnified, one of them collapsed.
Fig. 32. An ascus containing spores × 400.
Fig. 33. Spores × 400.
Fig. 34. Flocci of the subiculum × 400, one bearing a spore at the apex.
Fig. 35. Spores or conidia of the subiculum × 400.

SPHÆRIA MONOSPERMA *Peck.*

Page 79.

Fig. 36. Piece of wood bearing the fungus.
Fig. 37. A perithecium with its matrix magnified.
Fig. 38. An ascus containing an immature spore × 400.
Fig. 39. An ascus containing a mature spore × 400.

PLATE III.

RECEPTACULITES SUBTURBINATUS *Hall.*

Page 103.

Fig. 1. Lateral view of a specimen enlarged to two diameters.
Fig. 2. A further enlargement of the surface, showing the form of the cells.
Fig. 3. An enlarged summit view of another specimen.

ASTYLOSPONGIA PRÆMORSA *Goldfuss.*

Page 103.

Figs. 4, 5. Lateral and summit views of a specimen of medium size.
Fig. 6. View of the upper side of a more deeply lobed specimen.
Figs. 7, 8. Upper and lateral views of a very perfectly formed specimen, enlarged two diameters.
Figs. 9, 11. Vertical sections of two specimens showing structure, enlarged to two diameters. The dark spots in the center are filled with pyritous matter, and are not cavities.
Fig. 10. Horizontal section of another specimen, enlarged two diameters.
Fig. 14. A crushed and imperfect specimen, showing the radiating fibrous-like character of the substance (enlarged).

ASTYLOSPONGIA PRÆMORSA *var.* NUXMOSCHATA *n. var.*

Page 104.

Figs. 12, 13. Lateral and summit views of a specimen, showing the difference in the form and lobation of the surface from typical *A. præmorsa.*

ASTYLOSPONGIA (PALÆOMANON) BURSA *Hall.*

Page 105.

Figs. 15, 16. Lateral and profile views of a crushed specimen, showing the characters of the species.

(PETROSPONGIA.)

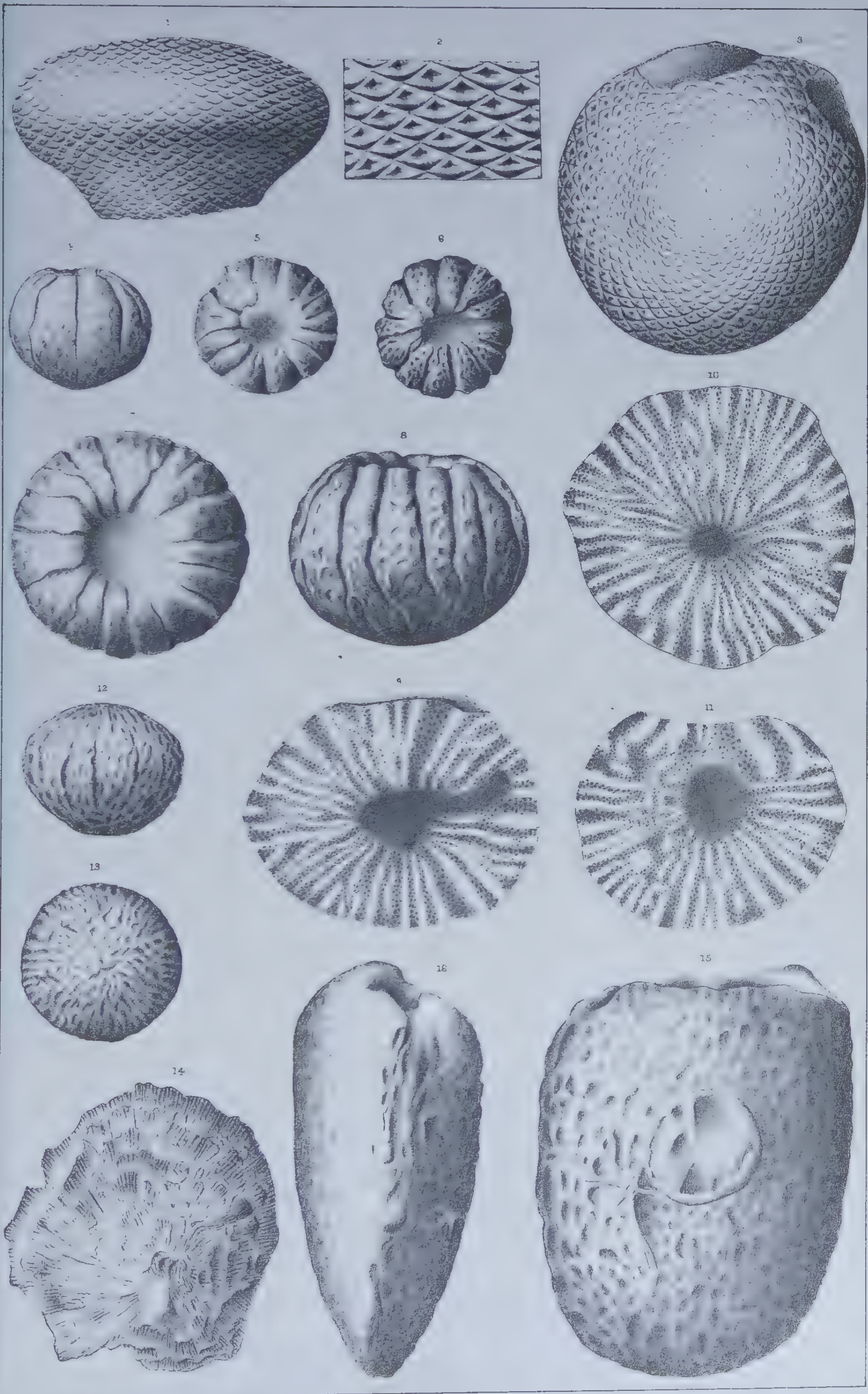

PLATE IV.

Favosites spinigerus *Hall.*

Page 108.

Figs. 1, 2. Upper and lateral views of a specimen of the usual character.

Fig. 3. Vertical section of a similar specimen, showing the divergence of the cells and the distant entire diaphragms.

Fig. 4. Vertical section of a specimen with larger cells.

Fig. 5. An enlarged oblique view of a portion of the surface, showing the irregular cells and the spiniform projection at the angles.

Favosites Forbesi *var.* occidentalis *n. var.*

Page 108.

Fig. 6. An irregularly hemispherical specimen, showing small cells with a few of somewhat larger size.

Figs. 7, 8. Turbinate forms with large irregular cells, the lower part covered by the epitheca.

Fig. 9. The upper side of a large irregular specimen.

Fig. 10. Lateral view of a large broadly turbinate specimen, having the lower part covered by the epitheca and showing in the upper part an irregular distribution of large and small angular cells.

Fig. 11. A vertical section of a specimen similar to fig. 8, showing the closely arranged diaphragms.

Fig. 12. An enlarged transverse section, showing the thick vertical walls.

Fig. 13. Enlarged vertical section showing the thick walls and large mural pores.

Fig. 14. The natural surface of a well-preserved specimen, showing the granulations upon the diaphragms.

Fig. 15. An oblique view of the same. In the figure the vertical walls are not sufficiently elevated above the diaphragms.

NIAGARA GROUP

State Mus Nat Hist 28

(CORALS.)

Plate 1

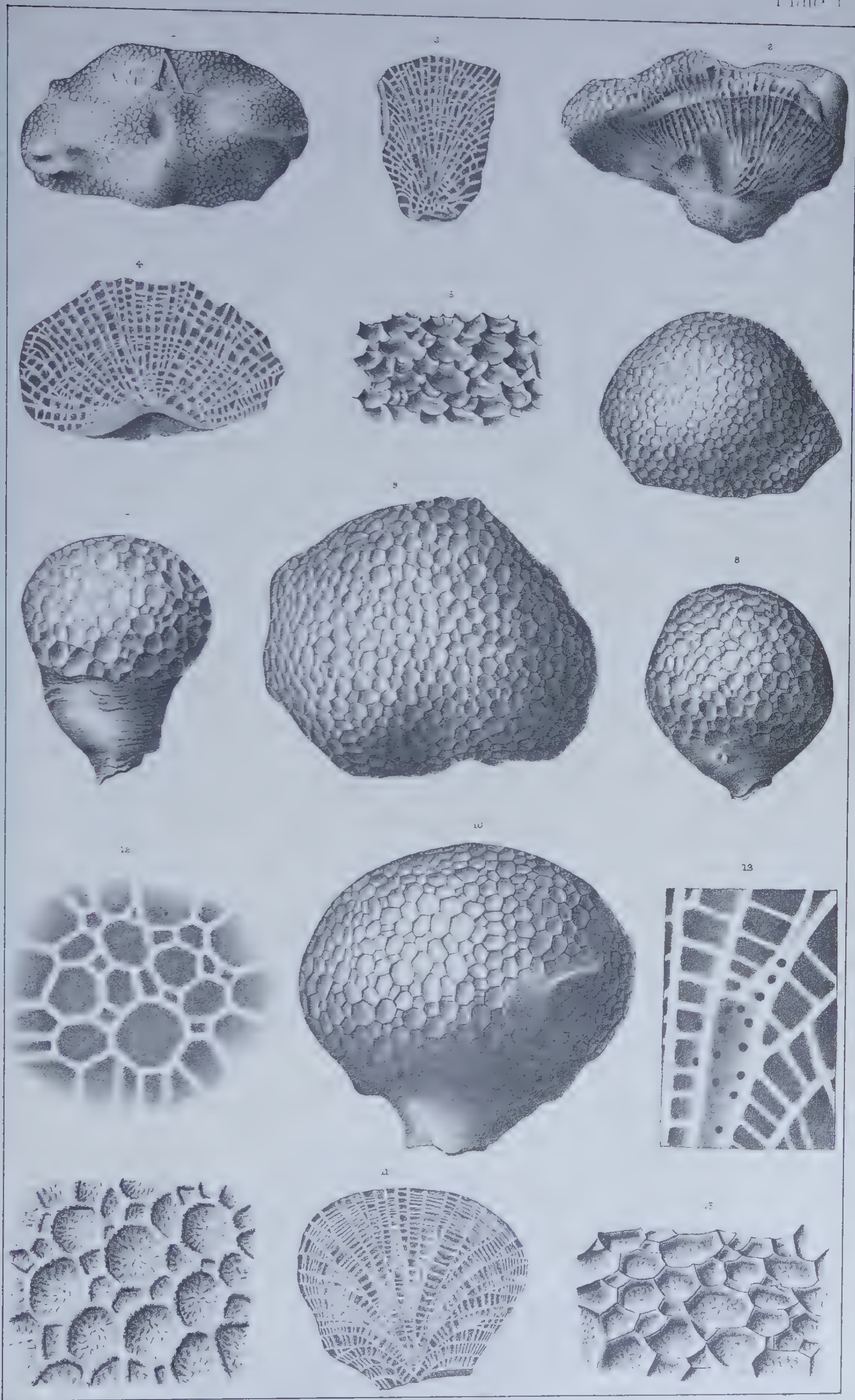

PLATE V.

Streptelasma radicans *Hall.*

Page 106.

Figs. 1, 2. Dorsal and ventral views of an imperfect specimen, showing the spreading root-like base.

Fig. 3. Lateral view of a similar specimen.

Fig. 4. An enlarged longitudinal section, showing the depth of the cup and the character of the lamellæ. The continuation of the lower part from the horizontal line is incorrectly represented, the lamellæ becoming obsolete and solid at a short distance below.

Zaphrentis celator *Hall.*

Page 107.

Figs. 5, 6. Lateral and posterior views of a specimen showing the form of the cup.

Streptelasma (Duncanella) borealis *Nicholson.*

Page 106.

Fig. 7. A fragment of rock showing two individuals of this species.

Fig. 8. An enlargement of one of the above to show the form and character of the exterior.

Lichenalia concentrica *Hall.*

Page 116.

Fig. 9. A small irregularly growing specimen.

Fig. 10. Another irregular specimen — the frond being enrolled upon itself.

Fig. 11. Section of the specimen fig. 10, showing the great increase in length of the cells on the enrolled portion.

Fig. 12. The celluliferous surface of a large irregular specimen which has encrusted other bodies, and in places shows a tendency to form tubular extensions and branches.

Fig. 13. An enlargement from the surface of the specimen fig. 9, showing the form and arrangement of cells.

Fig. 14. An enlargement from the surface of fig. 12, showing angular (subtriangular) cell-apertures. This character is shown only on a part of the surface, the other portions having oval or circular apertures.

Fig. 15. Enlargement from a specimen similar to fig. 13, but with larger cells.

Fig. 16. A portion of a *Strophostylus cyclostomus*, bearing four young specimens of Lichenalia and the base of a Cornulites; the entire surface of the shell below being covered by another Bryozoan (*Paleschara*).

Fig. 17. A young frond growing upon the surface of *Platyostoma Niagarense.*

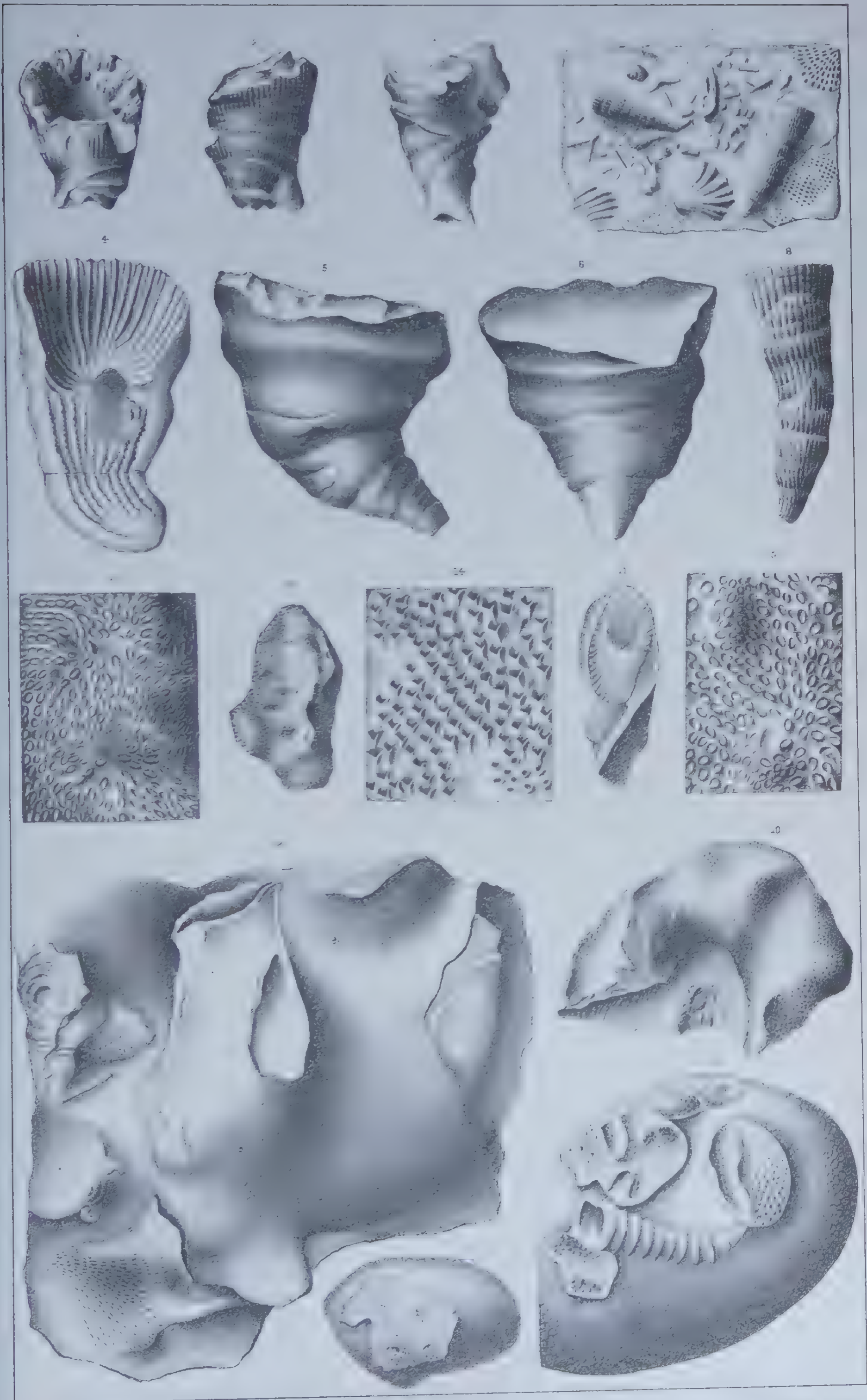

PLATE VI.

Lichenalia concentrica *Hall.*

Page 116.

Figs. 1, 2. The upper and lower surfaces of a young specimen, the latter showing a small cicatrice of attachment.

Fig. 4. The under surface of a specimen, showing the epitheca in its irregular growth, and its strong concentric markings.

Fig. 7. A fragment of Fenestella, having two young specimens of Lichenalia attached to the surface.

Fig. 8. The lower surface of a small fragment with scarcely any remaining epitheca, and so translucent that the structure is visible through the substance, showing the elongated cell-bases.

Fig. 9. The lower surface of a specimen corresponding to fig. 3, showing the concentric markings of the epitheca.

Fig. 10. The lower surface of a small specimen where the epitheca has been worn away or only partially developed, showing along the base, the radiating grooves formed by the cells before curving upward toward the surface.

Lichenalia concentrica *var.* maculata *n. var.*

Page 117.

Fig. 3. The upper or celluliferous surface of a regularly growing specimen of medium size, showing tubercles with maculæ of larger cells. The cells are represented much larger than they really are on the specimen. (See fig. 5.)

Fig. 5. A small irregular specimen, with unusually distinct maculæ upon the celluliferous surface.

Fig. 6. An enlargement from a part of the surface of specimen fig. 3, where it has been worn or macerated, showing the angular intercellular spaces.

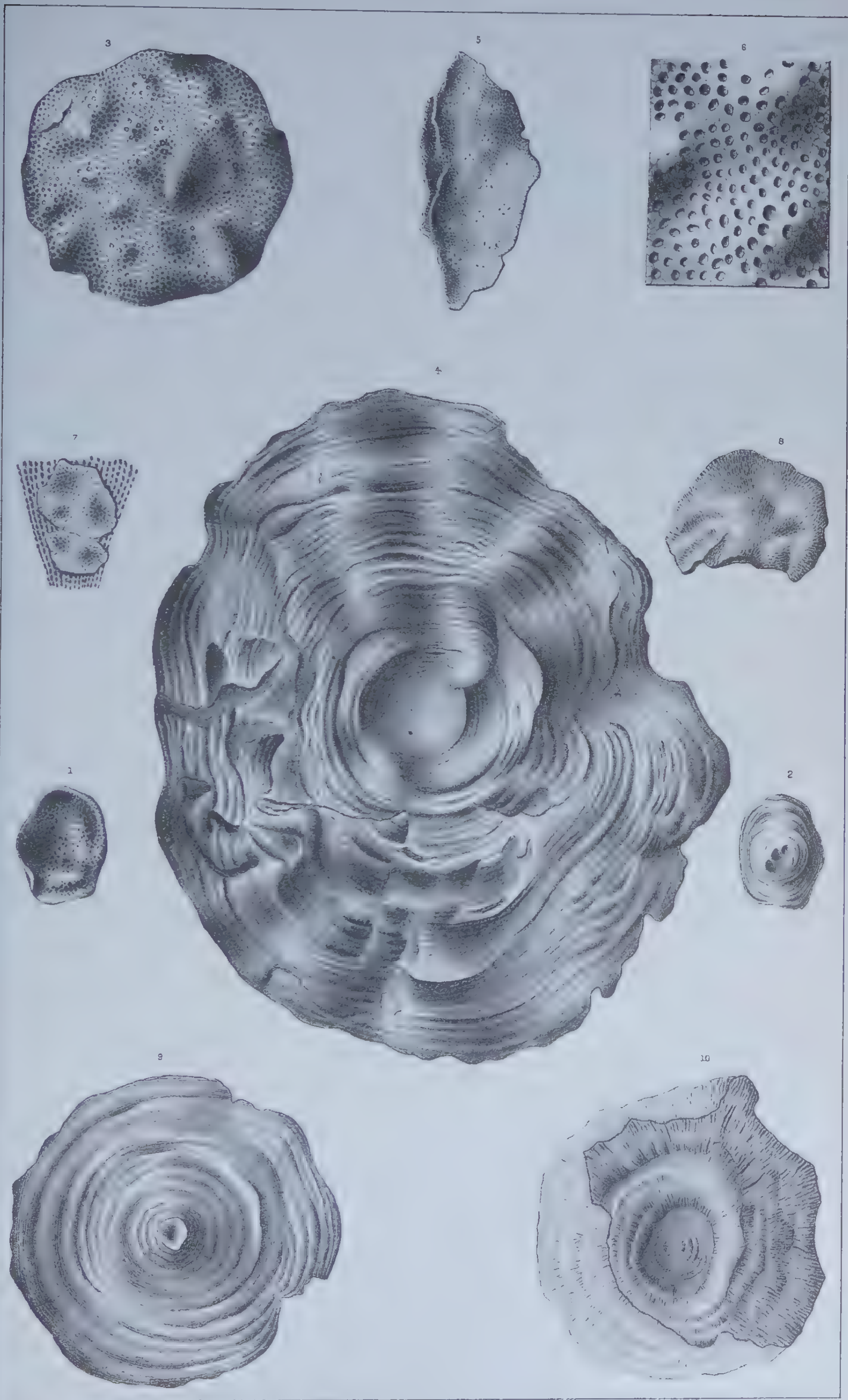

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PLATE VII.

LICHENALIA CONCENTRICA *var.* PARVULA *Hall.*

Page 117.

Fig. 1. A fragment of this form of Lichenalia which has grown upon the upper surface of a Strophostylus.

Fig. 2 An enlargement of a portion of the above, showing the cells to be much smaller and more distinctly circular than in the ordinary form of *L. concentrica.*

LICHENALIA CONCENTRICA *Hall.*

Page 116.

Fig. 3. An enlargement of a young Lichenalia, showing it as it has grown attached to the surface of an Atrypa.

Figs. 4, 5, 7, 8. Enlargements from the surfaces of Lichenaliæ as presented in different individuals. Figures 4 and 5 are respectively three and four diameters of the young specimens attached to Fenestella. (See pl. 12, fig. 3.)

Fig. 6. An enlargement to about four diameters of a group of two young Lichenaliæ and a young Favosites, attached to the shell of Strophostylus.

Figs. 9, 10. Enlargements from the lower surfaces of different individuals, showing the variable conditions of the epitheca. In fig. 9 the cell-partitions are shown through the texture; and fig. 10 presents a fibrous condition, from the removal of the epithecal covering leaving the projecting cell-walls.

Fig. 11. An enlarged transverse section of a specimen similar to fig. 4 of plate 6, showing the depth of the cells and the thickness of the epitheca in old individuals.

The variations in expression, in the many forms of this species, the size, proportion and arrangement of the cellules upon the surface, and the aspects produced by weathering or maceration are so great as often to induce a reference to distinct species. It does not, however, seem possible to convey in a satisfactory manner, the characters as they appear to the eye and under a lens.

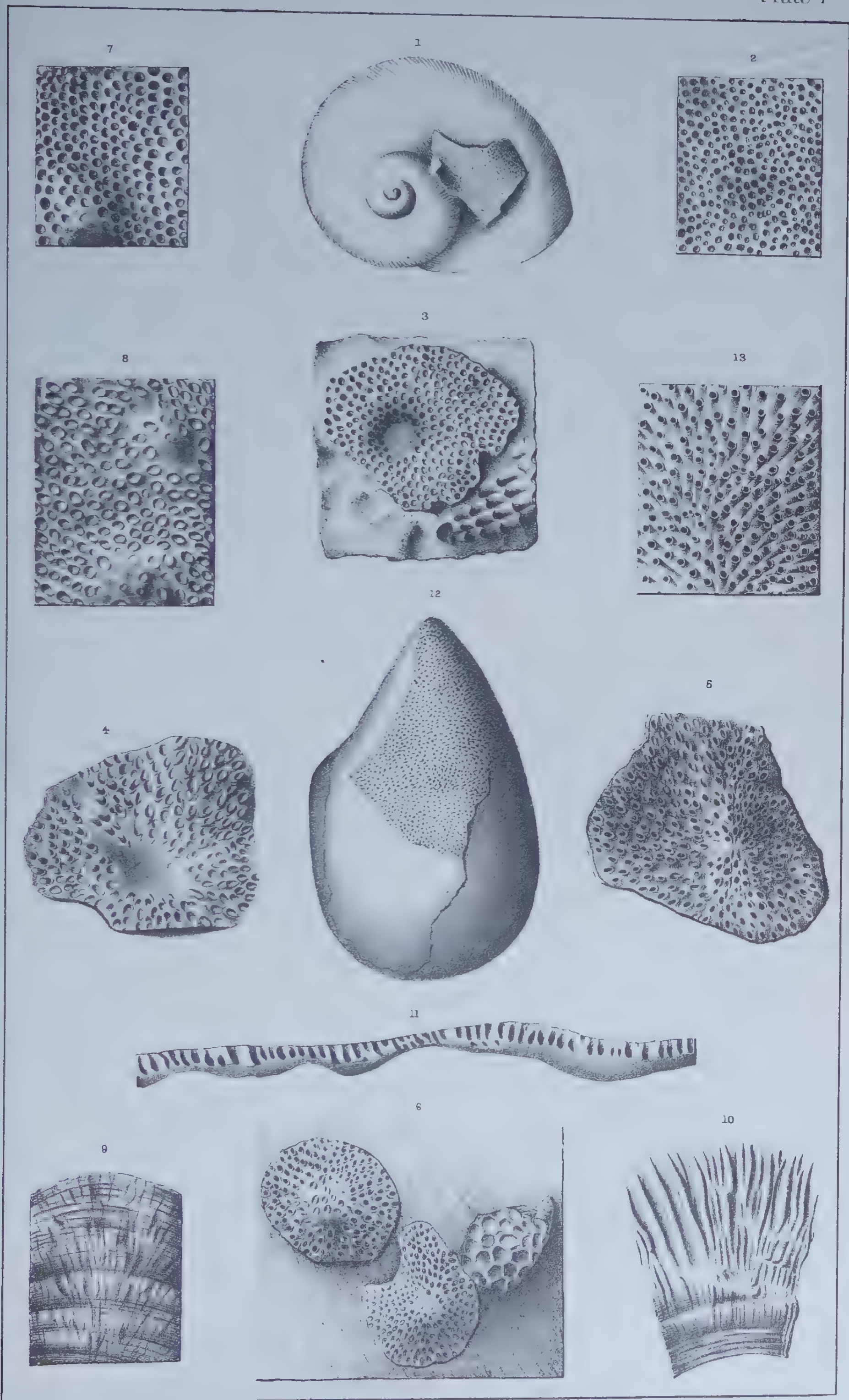
SAGENELLA ELEGANS *Hall.*

Page 118.

Fig. 12. The right valve of *Ambonychia acutirostra*, showing the encrusting membraneous bryozoan upon its surface.

Fig. 13. An enlargement of a portion of the same specimen to show the tubular cells and their apertures.

(BRYOZOA.)



G. B. Simpson, del.

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PLATE VIII.

Ceramopora labecula *Hall.*

Page 119.

Fig. 1. A small colony of the bryozoan, attached to the surface of a Fenestella. showing distinct rounded tubular cells : enlarged to six diameters. In the figure, the cells are a little too distinctly individualized.

Fig. 2. A fragment of Fenestella upon which are two separate colonies of the species, enlarged to the same degree as in the preceding figure.

Fig. 3. Another and larger separate colony enlarged to the same degree. This and the colony in fig. 2 show the ordinary forms of cell pertaining to the species.

Ceramopora confluens *Hall.*

Page 119.

Fig. 4. The bryozoan entirely encrusting a specimen of *Platyostoma Niagarense.*

Fig. 5. An enlargement to show the character of the cells and the centers of radiation forming tubercles. The cells radiate a little more distinctly from these centers than is apparent in the figure.

Ceramopora agellus *Hall.*

Page 120.

Fig. 6. A colony attached to the surface of *Strophostylus cyclostomus.* The cells are largest at the initial point near the lower end, and gradually decrease toward the margin, where they are exceedingly minute. Enlarged to four diameters.

Paleschara offula *Hall.*

Page 120.

Fig. 7. A fragment (natural size), encrusting some foreign substance.

Fig. 8. An enlargement of a portion of the surface to six diameters, showing the character of the cells.

Paleschara maculata *Hall.*

Page 121.

Fig. 9. A specimen (natural size), encrusting some foreign cylindrical body.

Fig. 10. An enlargement of the surface to the same degree as fig. 8, and presenting also, near the center of the figure, one of the maculæ of larger cells.

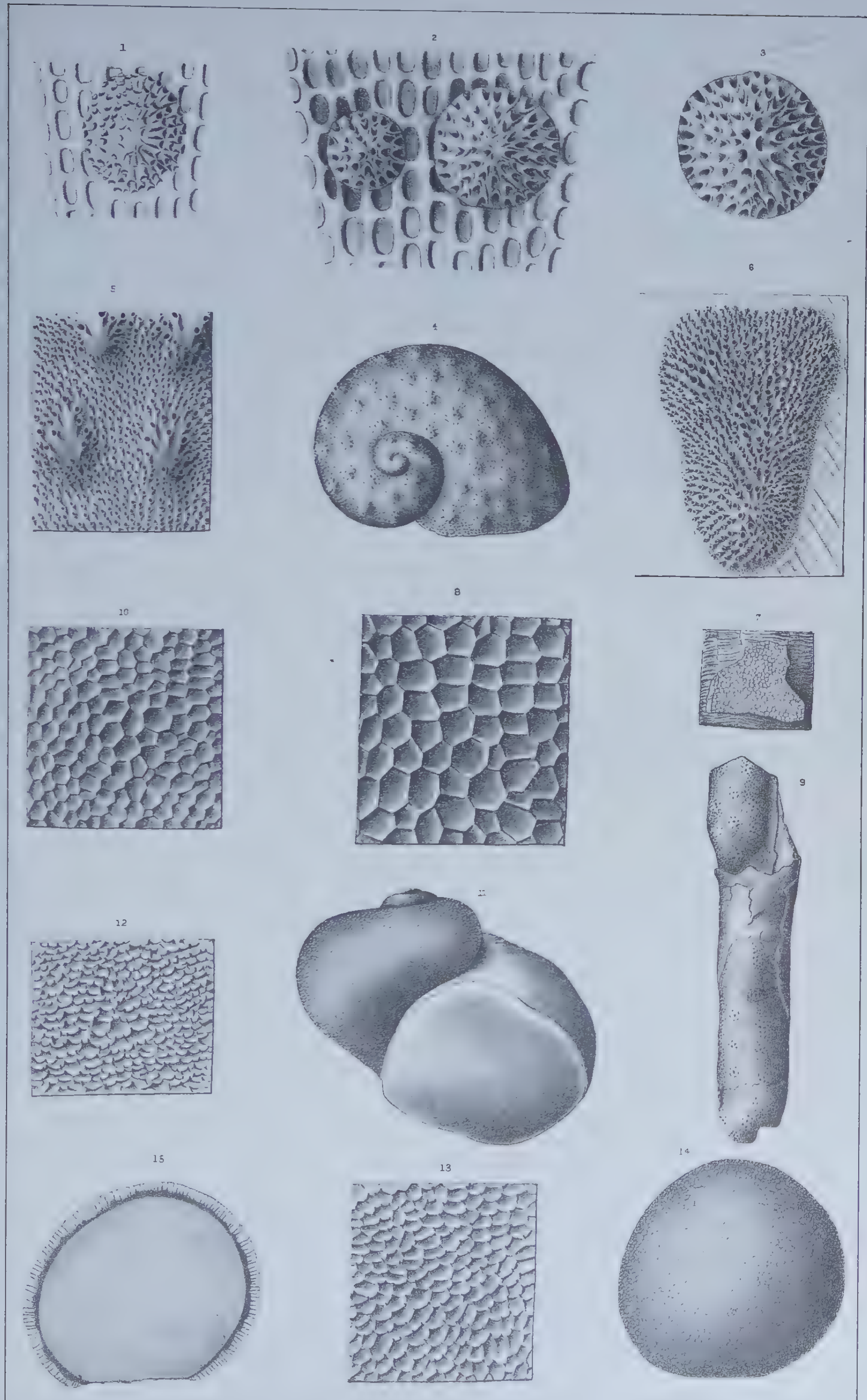
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PLATE VIII—(*Continued*).

Fig. 11. A specimen of Platyostoma having the surface covered by the substance of the bryozoan.

Fig. 12. An oblique lateral view of a portion of the surface, showing the asperities at the angles of the cells. Enlarged to six diameters.

Fig. 13. An enlarged view of the same, looking directly upon the cell-apertures.

PALESCHARA ? (CHÆTETES ?) SPHÆRION *Hall*.

Page 121.

Fig. 14. View of one side of the colony, enlarged to two diameters, showing the arrangement of the cells.

Fig. 15. A section through the center of the specimen, enlarged to the same degree as fig. 14. The dark line at the base of the cells represents the solid substance of the cell floor, the inner space being filled with inorganic calcareous clay.

PLATE IX.

Favosites spinigerus *Hall.*

Page 108.

Fig. 1. The upper surface of a specimen, the cells of which are smaller than those of the specimen represented on plate 4, and without the processes at the angles of the cells.

Fig. 2. An enlargement to four diameters of a portion of the surface.

Callopora exsul *Hall.*

Page 115.

Fig. 3. The upper side of a specimen (natural size).

Fig. 4. An enlargement of the cell-apertures. The original of this figure is a specimen of Callopora incrusting and partially covering a Ceramopora, and the form of the cell-apertures represents the latter genus while the denticulate margins are of Callopora.

Aulopora precius *Hall.*

Page 107.

Fig. 5. A colony attached to the surface of *Meristina nitida.*

Fig. 6. Enlargement from the preceding specimen, showing the form and character of the cells.

Chætetes consimilis *Hall.*

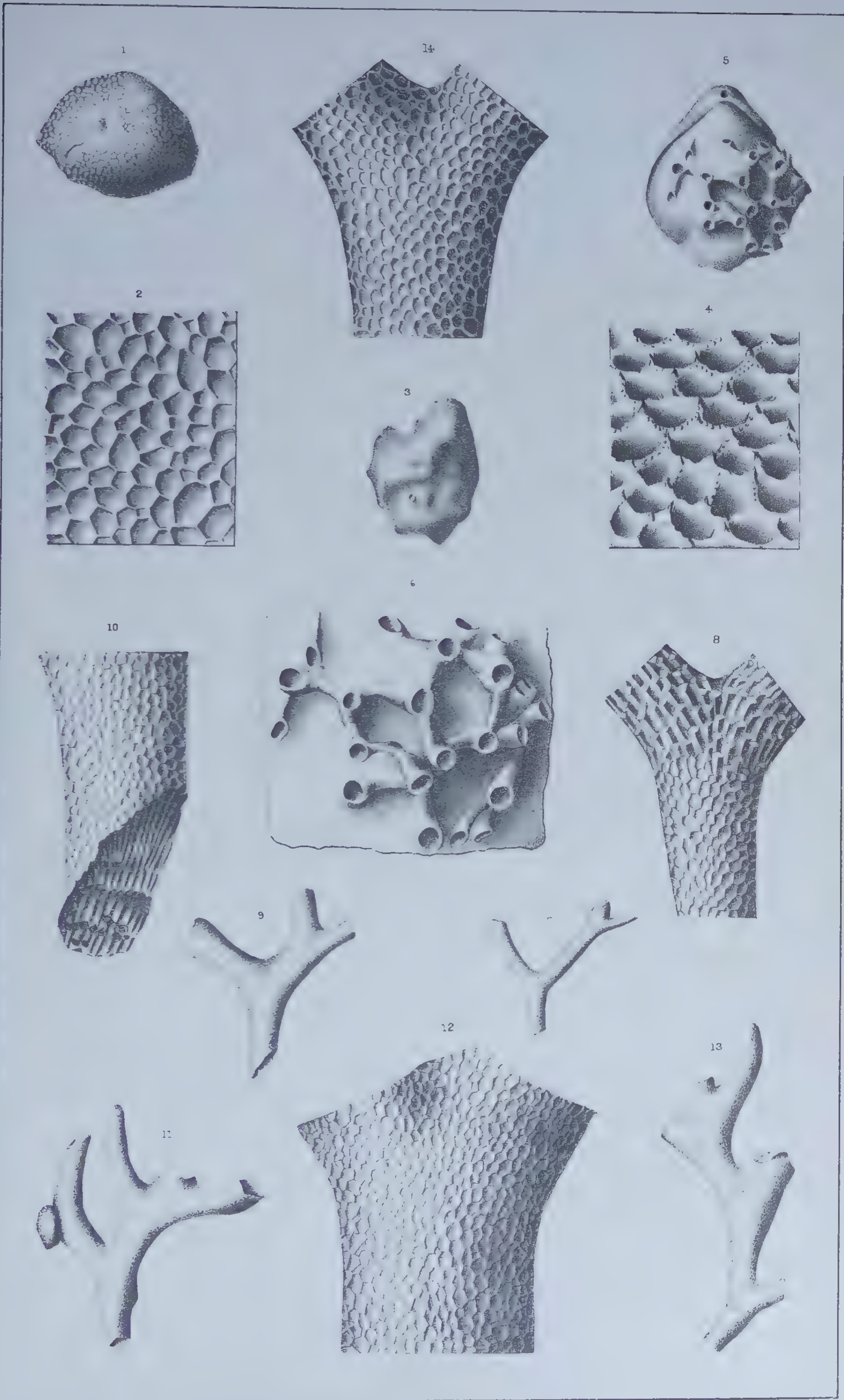
Page 110.

Figs. 7, 8. A specimen, natural size, and an enlargement to five diameters, from the lower bifurcation, where the tubes have grown so as to leave the cell-walls exposed.

Figs. 9, 10. A specimen, natural size, and an enlargement from the lower end, showing the solid stem with columnar structure, and angular cell-apertures.

Figs. 11, 12. Another individual, and an enlargement from the lower bifurcation, showing the young cells in the angles of the larger ones.

Figs. 13, 14. Another individual and an enlargement of the same, where the cell-walls are flattened on the surface, as from wearing. All the enlargements are to five diameters.



G. B. Simpson. del.

PLATE X.

CALLOPORA SINGULARIS *Hall.*

Page 115.

Figs. 1, 2. A specimen, natural size, and an enlargement, showing the arrangement of the cells. The interstices of the intercellular spaces as represented are too small and indistinct.

TREMATOPORA INFREQUENS *Hall.*

Page 111.

Fig. 3. A fragment of shale, with a group of stems of which one specimen is of this species. Natural size.

Fig. 4. Enlargement of a bifurcation from the individual on the right hand side of the specimen fig. 3.

TREMATOPORA OSCULUM *Hall.*

Page 110.

Figs. 5, 6. A specimen, natural size, and enlarged, showing cells of smaller size than the preceding species.

Figs. 7, 8. A specimen, natural size, and enlarged, showing the cell-apertures more crowded and more exsert than in the last.

Figs. 11, 12. A specimen which appears to have been tubular, with scattered pores. The enlargement, fig. 12, does not fully represent the object.

Fig. 13. A specimen, natural size.

Fig. 14. The same enlarged.

TREMATOPORA SUBIMBRICATA *Hall.*

Trans. Alb. Inst., vol. X.

Figs. 9, 10. A specimen showing arrangement of the cells opening obliquely upward, and the upper margin not elevated.

TREMATOPORA VARIA *Hall.*

Page 111.

Figs. 15, 16. A specimen, natural size and enlarged. The cell-apertures appear to have been worn or dissolved away, giving the appearance of double cell-walls. Enlargement eight diameters.

Figs. 17, 18. Another individual showing the apertures reduced in size by the contracted margins. Enlargement about six diameters.

Figs. 19, 20. A specimen in which the cells are irregular in size, some of them with elevated margins and others without.

Figs. 21, 22. A thickened branching form, with the branches flattened above, and showing other variations in the form and size of cells. This and the preceding enlargement are four diameters each.

Fig. 23. Tranverse section of the lower part of the specimen fig. 21, showing a hollow tube, and the mode of growth of the cells.

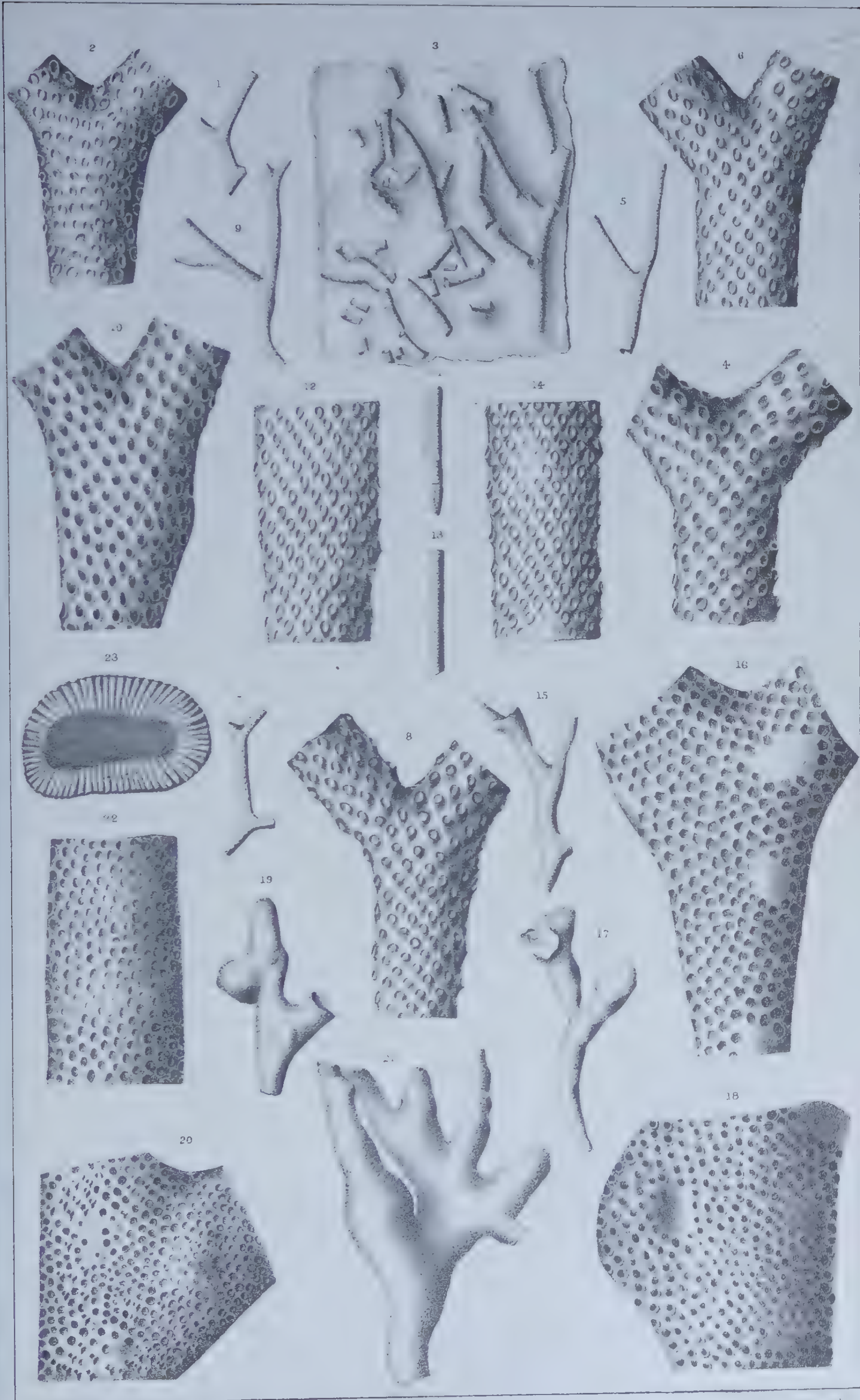

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PLATE XI.

TREMATOPORA ECHINATA *Hall.*

Page 112.

Figs. 1, 2. A small branch, natural size, and an enlargement of the bifurcation, showing the character of the cells.

Fig. 3. An enlargement from another individual where the cells are not so elongate as in the preceding one. This one and fig. 2 are enlarged eight diameters.

Fig. 4. An enlargement to twelve diameters from a specimen preserving, in great perfection, the spines at the cell-angles.

Fig. 5. A still further enlargement of the walls of a cell.

TREMATOPORA GRANULIFERA *Hall.*

Page 112.

Fig. 6. An enlargement of a bifurcating branch, to two diameters.

Fig. 7. A still further enlargement from the above specimen, to show the arrangement of cells and the granulations on the intercellular spaces.

TREMATOPORA MINUTA *Hall.*

Page 113.

Fig. 8. An enlargement to about twelve diameters, of a small branch of this species, showing the arrangement of cells.

TREMATOPORA VARIOLATA *Hall.*

Page 113.

Fig. 9. A branch of the species, natural size.

Fig. 10. An enlargement from a part of the same, showing the scattered pores.

TREMATOPORA SPICULATA *n. sp.*

Page. 114.

Fig. 11. A specimen of the natural size, showing the mode of growth.

Fig 12. An enlargement from the central portion of the specimen, showing the character of the surface and the minute spinules at the angles of the cells.

STICTOPORA SIMILIS *Hall.*

Page 122.

Figs. 13, 14. A small bifurcating fragment with oval cellules, natural size and enlarged.

Figs. 15, 16. Similar views of another individual of greater width, showing more crowded cellules.

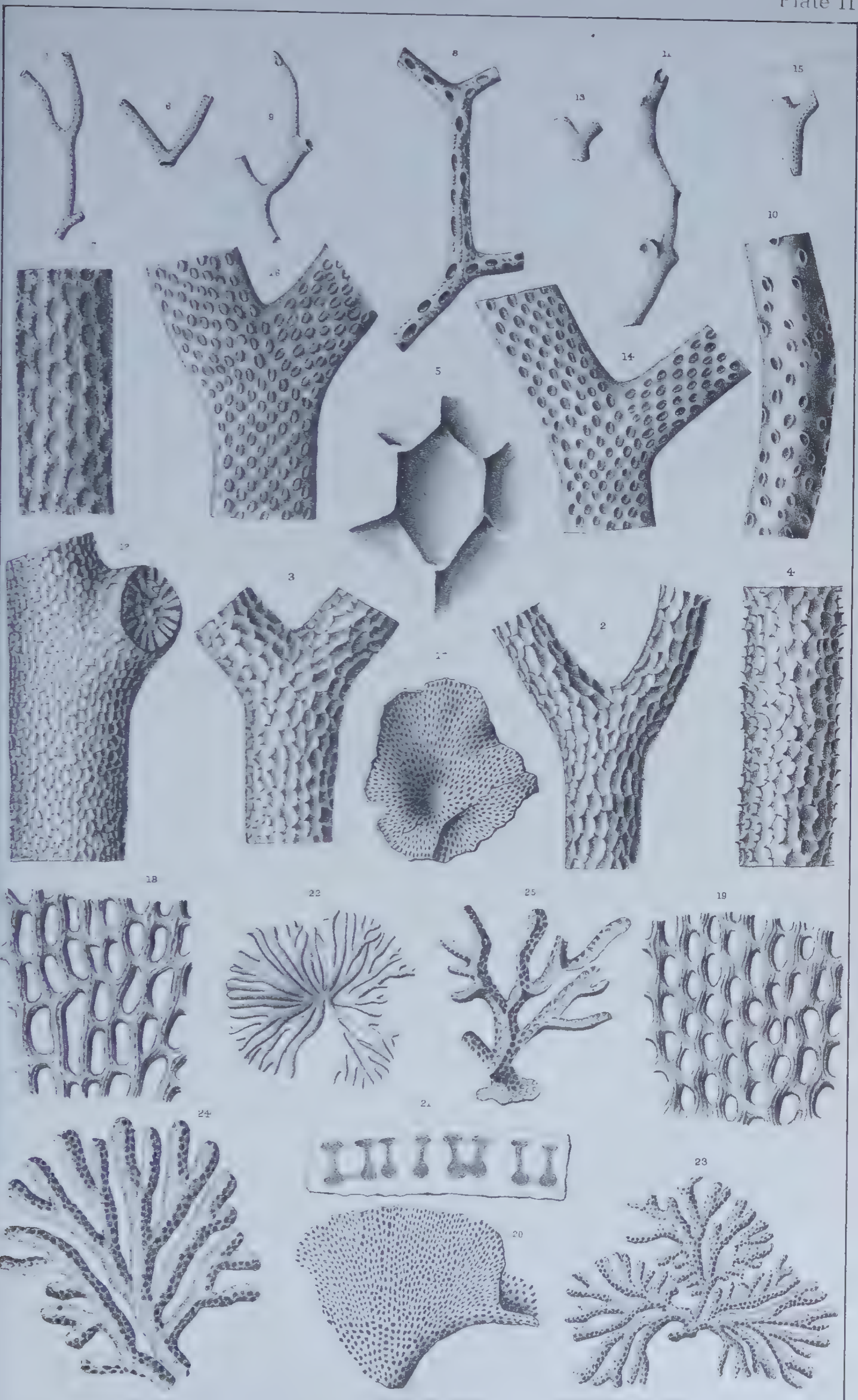

PLATE XI — (*Continued*).

FENESTELLA AMBIGUA *n. sp.*

Page 123.

Fig. 17. The inner surface of a frond, natural size.

Figs. 18, 19. Enlarged views of the opposite faces of the above specimen, showing a slight difference in the character of the striation of the two sides of the frond.

Fig. 20. The exterior surface of a flattened frond, showing a portion of the interior surface at the right hand side.

Fig. 21. An enlargement from the edge of the specimen fig. 20, showing a section. The rays of the inner and outer layers of the frond are connected by the vertical extensions, and the rays of the same layer connected by the transverse or horizontal dissepiments.

THAMNISCUS NIAGARENSIS *Hall.*

Page 126.

Fig. 22. The non-poriferous face of a frond, natural size, showing the mode of growth and absence of transverse dissepiments.

Fig. 23. An enlargement of the poriferous face of a frond, to two diameters.

Fig. 24. A still farther enlargement of the right hand third of the frond fig. 23, to show the angular crest of the branches and the disposition of the pores upon its surface.

Fig. 25. An enlargement, to three diameters, of another fragment, showing the base of attachment, the angular crest of the branches and the extensions of the pores over the root-like base.

PLATE XII.

FENESTELLA PARVULIPORA *Hall.*

Page 123.

Fig. 1. The non-poriferous surface of a fragment of a frond, natural size.

Fig. 2. An enlargement of a portion of the same to show the character of the surface and mode of reticulation.

Fig. 3. A similar fragment, having young specimens of Lichenalia and Ceramopora growing upon its surface (see plate 7, figs. 4 and 5, and plate 8, figs. 1 and 2).

Fig. 4. An enlargement from a portion of the opposite or celluliferous face of the frond fig. 3.

Fig. 5. A still farther enlargement of this surface, to show more distinctly the arrangement of pores and the line of nodes on the median crest.

Fig. 6. An enlargement of the non-celluliferous face of the same frond, fig. 3, showing the absence of striation upon the surface.

Fig. 7. A portion of a very large frond, natural size, showing the general aspect of the species.

Fig. 8. An enlargement of the surface of the specimen fig. 7, showing the existence of very fine striæ.

Fig. 9. The interior of a frond, retaining the cup-shaped form. The surface here presented is non-celluliferous.

FENESTELLA ACMEA *Hall.*

Page 124.

Fig. 10. The outer surface of a funnel-shaped frond, presenting the celluliferous side.

Fig. 11. An enlargement of a part to show the arrangement of the branches, the form of the cells and the median ridge, with its flattened spreading crest, which is seen on some of the rays in the upper part of the figure, and on all below the bifurcation, while it is broken away in places, revealing the narrow slit thus left, which passes into the cavity of the ray below.

Fig. 12. Another fragment of the same species.

Fig. 13. An enlargement from a part of the preceding specimen, presenting wider fenestrules, and having the median crest entirely removed, showing only the narrow slit passing into the cavity of the branch. The connecting fenestrules are obscured over a part of this figure, as in fig. 11.

Fig. 14. An enlargement, to two diameters, of a part of a frond.

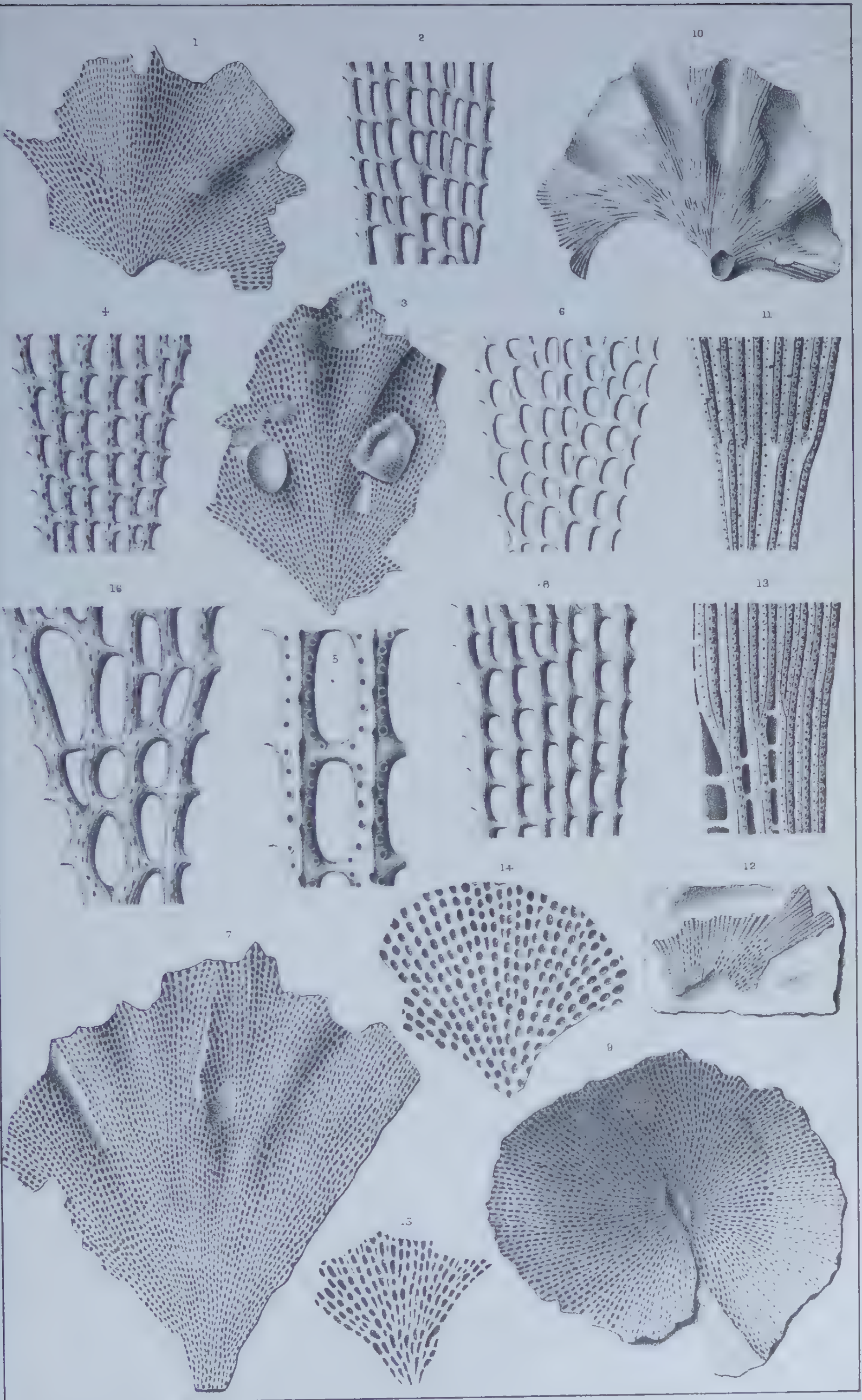
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PLATE XII.—(*Continued*).

FENESTELLA PUNCTOSTRIATA *Hall*

Page 125.

Fig. 15. A fragment of a frond of this species.

Fig. 16. An enlargement of a portion of the same, showing the peculiar striation and pitting of the non-celluliferous surface.

PLATE XIII.

Macrostylocrinus striatus *Hall.*

Page 129.

Fig. 1. Lateral view of a small individual which shows the striations of the surface very perfectly.

Figs. 2, 3. The posterior and basal views of a larger specimen. The striations of the surface are not represented in the figure.

Fig. 4. An enlargement of the basal plate and one ray, showing the character of the surface striæ.

Macrostylocrinus fasciatus *Hall.*

Page 130.

Figs. 5, 6. Lateral and basal views of a specimen, enlarged two diameters.

Glyptaster occidentalis *Hall.*

Page 133.

Figs. 7, 8. Basal and lateral views of a small, very perfectly preserved individual, enlarged to two diameters.

Fig. 9. Two of the rays with the interradial area still farther enlarged to show the character of the surface-markings.

Fig. 10. The anterior side of a larger specimen, from which the basal plates have been removed, and the ridges not developed on the subradials.

Fig. 11. The posterior side of the same specimen as fig. 10.

Saccocrinus Christyi *Hall.*

Page 127.

Fig. 12. An enlargement to two diameters of the anal side of a small specimen, showing a small number of anal plates.

Fig. 13. Antero-lateral view of a larger specimen, on which the surface-striæ are very perfectly preserved.

Figs. 14, 15. The right and left sides of another individual.

Fig. 16. Anterior side of a larger specimen.

Fig. 17. The posterior side showing a larger number of plates than in fig. 12.

Figs. 18, 19. The anterior and anal sides of a large specimen, which is slightly imperfect and somewhat obscured by attached bryozoans.

Fig. 20. An enlarged ray from specimen fig. 13, to show the character of surface-striæ.

NIAGARA GROUP.

(CRINOIDEA.)

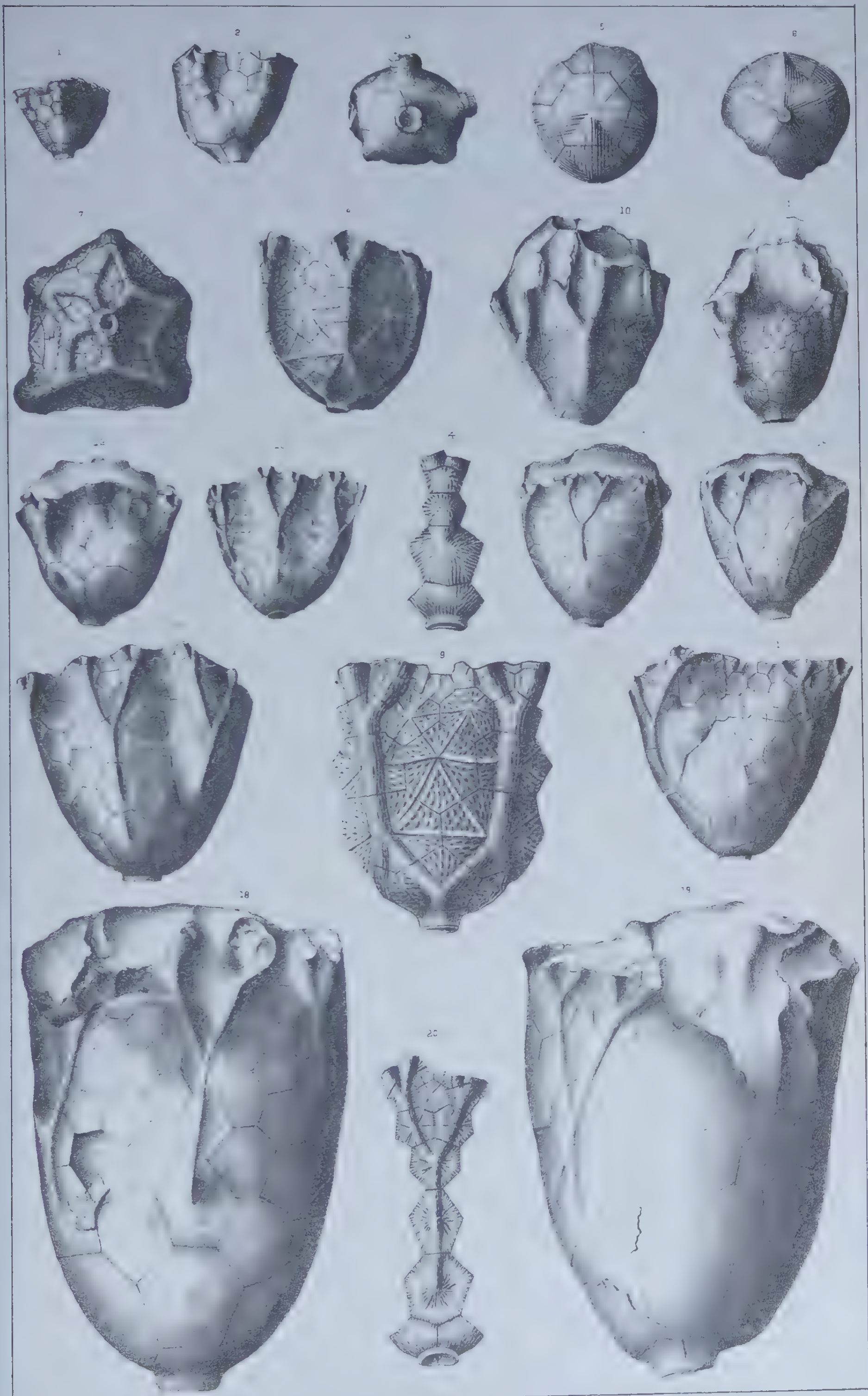


PLATE XIV.

Glyptaster inornatus *Hall.*

Page 134.

Fig. 1. The anal area of a specimen which preserves the entire calyx.

Fig. 2. The anterior side of the same.

Fig. 3. A basal view of the same specimen.

Fig. 4. A basal view of the specimen fig. 6.

Fig. 5. A lateral view of the lower part of a calyx, on which the surface ornamentation is only partially developed.

Fig. 6. Lateral view of the specimen fig. 4, showing a grade of development of the surface ornamentation intermediate between specimens figs. 1 and 5.

Glyptocrinus Carleyi *Hall.*

Page 132.

Figs. 7, 8. Right and left lateral views of a nearly entire body, showing the general features of the species to the second bifurcation of the arms.

Fig. 9. A basal view of the preceding specimen.

Fig. 10. An enlargement of the central portion of fig. 8, to show more distinctly the surface characters.

Melocrinus obconicus *Hall.*

Page 138.

Figs. 11, 12. Lateral and anterior views of a specimen, enlarged to two diameters, showing the form of plates and character of surface.

Fig. 13. The summit correspondingly enlarged, showing the plates of the dome.

Fig. 14. Basal view enlarged, as the preceding figures.

Stephanocrinus gemmiformis *Hall.*

Page 146.

Figs. 15–17. Summit, basal and lateral views, enlarged to three diameters, showing the form and character of the body. The plates of the third range are shown upon the summits of the divisions of the calyx. Fig. 17 shows the characters of the surface-markings.

Figs. 18–20. Lateral, basal and summit views of a larger specimen, somewhat different in form, with the third range of plates of larger size. Enlarged to three diameters.

NIAGARA GROU

(CRINOIDEA.)

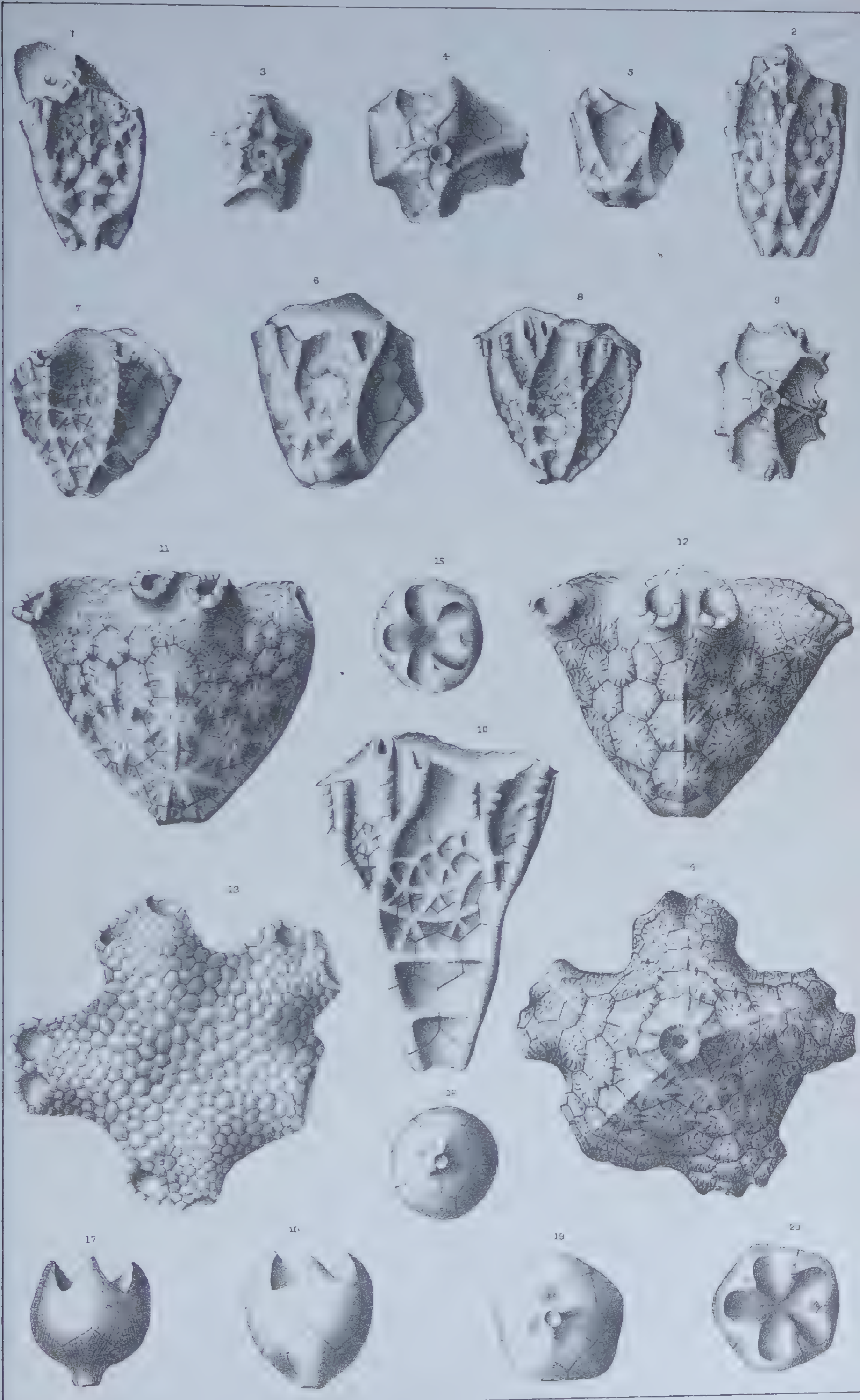


PLATE XV.

Lecanocrinus pusillus *Hall.*

Page 136.

Figs. 1, 5. Anterior and posterior views of a calyx preserving the first and second anal plates; enlarged to two diameters.

Figs. 3, 4. Similar views of another specimen, natural size, where the two anal plates of the preceding specimen are represented by one only.

Fig. 2. The lower side of the last specimen, showing the size of the basal plates.

Fig. 6. An enlargement of a first radial plate, to show the surface-markings.

Cyathocrinus nucleus *Hall.*

Page 136.

Figs. 7, 8. Lateral and anterior sides of the specimen, enlarged to four diameters, showing its form and character.

Fig. 9. Basal view of the same, enlarged to four diameters showing the lobation of the body at the base of the arms.

Cyathocrinus Polyxo *Hall.*

Page 135.

Figs. 10, 11. Lateral and basal views of a small specimen showing the basal plates with a small perforation in the middle.

Fig. 12. Anterior view of a larger specimen, showing the usual character of the species.

Figs. 13, 14. Posterior and basal views of a large individual, showing the very large second anal plates, and large opening through the basals. In this specimen the angular character of the plates, as observed in younger specimens, is greatly subdued.

Figs. 15, 16. Posterior and basal views of a specimen, showing features similar to the last.

Fig. 17. Posterior side of a specimen, showing a part of a third anal plate.

Rhodocrinus (Lyriocrinus) Melissa *Hall.*

Page 139.

Fig. 18. The summit of a large individual preserving the plates of the dome and also showing evidence of a subcentral proboscis.

Fig. 19. Basal view of a large imperfect specimen, showing flattened nodes on the subradial plates.

Figs. 20, 21. Basal and lateral views of a very symmetrical specimen, presenting the general form and features of the species to the arm-bases.

Fig. 22. Basal view of a specimen of ordinary size, showing a thickened, depressed, pentagonal ring around the column cicatrice, and incipient or developed nodes on the first radial plates. The surface of the plates is beautifully striated.

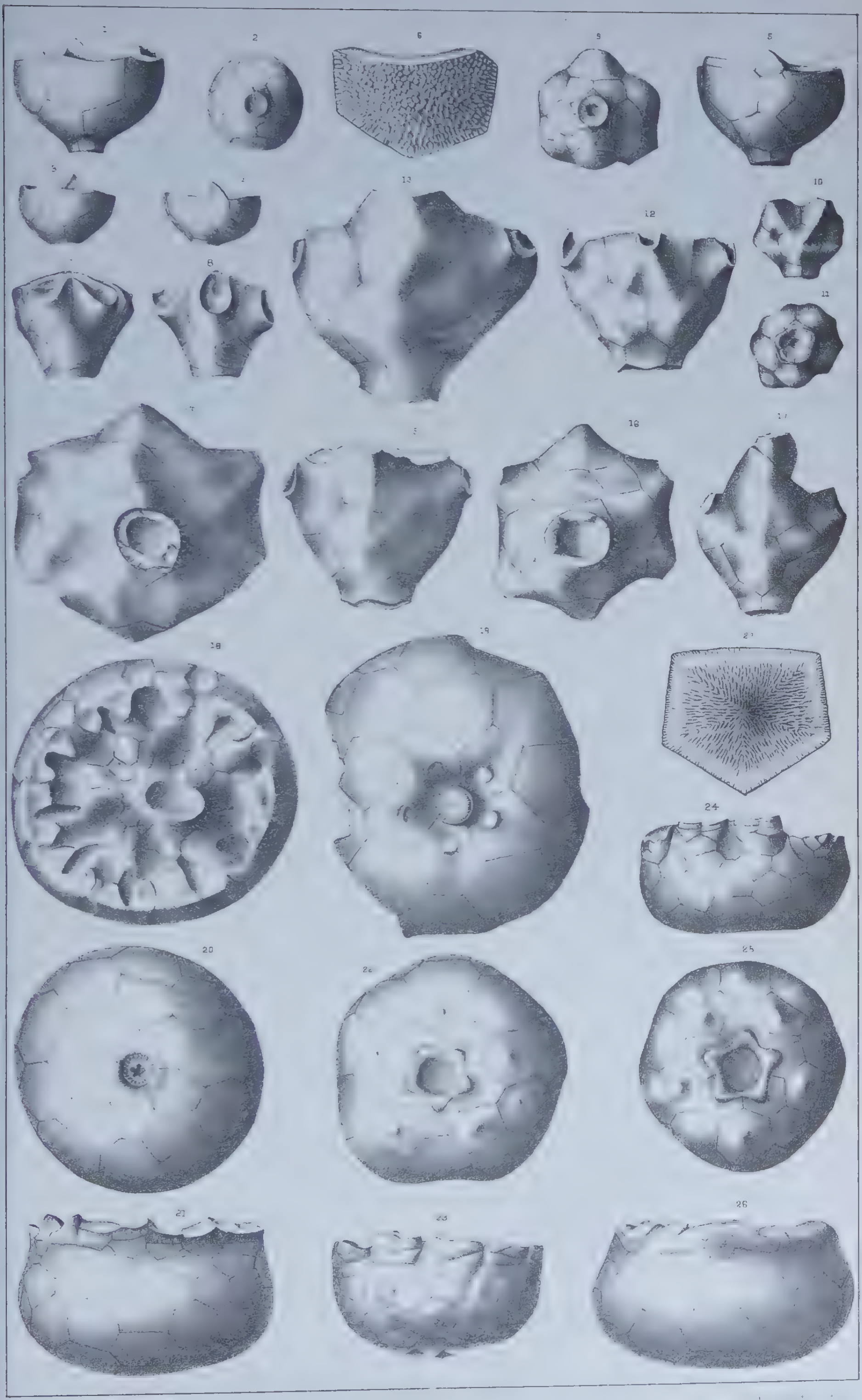


PLATE XV — (*Continued*).

Fig. 23. Lateral view of a similar individual, enlarged to two diameters, showing a projecting pentalobate base with nodose radial and interradial plates.

Fig. 24. Lateral view of the specimen fig. 22, showing arm-bases with arm-plates attached.

Fig. 25. Basal view, enlarged, of the specimen fig. 23, showing the nodes on the first radial plates.

Fig. 26. Lateral view of the specimen fig. 18.

Fig. 27. An enlargement of a first radial plate of specimen fig. 22, showing the character of the surface-striæ.

PLATE XVI.

Eucalyptocrinus cælatus *Hall.*

Page 142.

Fig. 1. A young individual enlarged to three diameters. The divisions of the arm-plates are incorrectly represented.

Fig. 2. A larger individual preserving the arms in place, but the divisions of the arm-plates are not fully shown in the figure.

Fig. 3. Lateral view of the calyx of a full-grown individual, of the prevailing form.

Fig. 4. Basal view of the same.

Fig. 5. A lateral view of a specimen showing the calyx and the solid interbrachial plates of one side.

Fig. 6. The opposite side of the same specimen, which is broken so as to reveal the visceral cavity, above which are the interior dome plates, covering the canal leading to the exterior. These anchylosed plates are embraced and supported by the inner edges of the interbrachial plates, as shown in the figure.

Fig. 7. The summit of the same specimen, showing the interbrachial plates, and the accessory plates, surrounding the orifice at the summit. The upper side of the figure, where the exterior is broken away, shows distinctly the bases of two interbrachial plates, and the projecting angles of the interior dome plates.

Fig. 8. The upper margin and interior of a calyx, showing the plates and cicatrices for the attachment of the arms and interbrachial plates.

Figs. 9, 10. Interior and lateral views of the basal and subradial plates of the species, showing the division of the basal plates, as seen on the inner side, and their great development in the interior of the calyx.

These are rarely distinguishable within the column cavity, and probably never on the exterior surface.

Ichthyocrinus subangularis *Hall.*

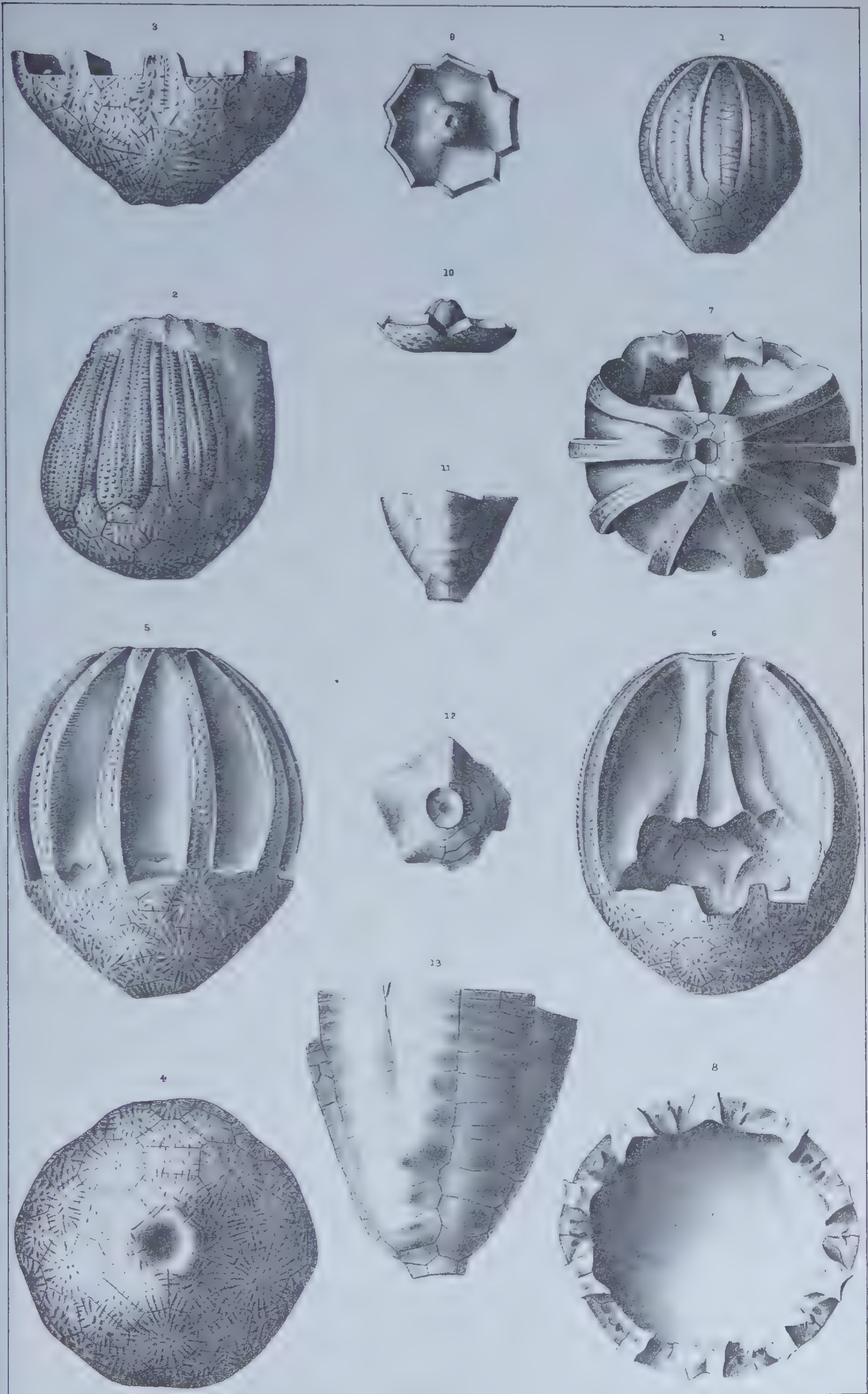
Page 137.

Figs. 11, 12. Lateral and basal views of a fragment, showing subradial and radial plates with a decided pentangular outline.

Fig. 13. Lateral view of a larger fragment, showing the rays to near the third division on two of the series, and a less decided subangularity of the body in the lower parts than the preceding specimen.

NIAGARA GROUP.

(CRINOIDEA.)



G.E. Simpson, del

PLATE XVII.

Eucalyptocrinus crassus *Hall.*

Page 141.

Fig. 1. A young individual, natural size, showing the immature character of the arms.

Fig. 2. An enlargement, to three diameters, of another young specimen, showing the immature character of the arms. The plates of the body have the same features as in the more advanced stages of growth.

Fig. 3. A young specimen retaining the interbrachial plates, but without the arms, the impression of the tentaculæ being retained on the sides of these plates.

Fig. 4. A young specimen similar to the preceding, referred to this species, but of a more globular form and spreading calyx.

Fig. 5. A young individual retaining the arms in place, and having the column and roots entire.

This is the only specimen yet found, retaining all the parts complete, among many hundreds of imperfect individuals which have been collected at the locality.

Fig. 6. Lateral view of an extremely elongated calyx.

Fig. 7. Lateral view of a more spreading form, retaining parts of the arms in place.

Fig. 8. Lateral view of a more elliptical specimen, preserving the interbrachial plates without the arms.

Fig. 9. A fragment of a column from the upper and middle portions, belonging apparently to a medium-sized specimen of this species. Two colonies of Favosites have commenced their growth upon it.

Fig. 10. The lower part of an interbrachial plate, showing the impression of the tentaculæ and the arm-plates.

Fig. 11. An enlargement of a part of an arm, showing the tentaculæ and edges of the arm-plates.

Eucalyptocrinus ovalis *Troost.*

Page 143.

Fig. 12. Lateral view of a very perfect specimen, possessing the form and general characters of the species ascribed to it by Dr. Troost. The arms of this species appear more mature than the young referred to *E. crassus*, except in the specimen figure 5.

Fig. 13. An enlargement of the summit of the specimen fig. 12, showing the arrangement of the plates at the summit with the oral plates.

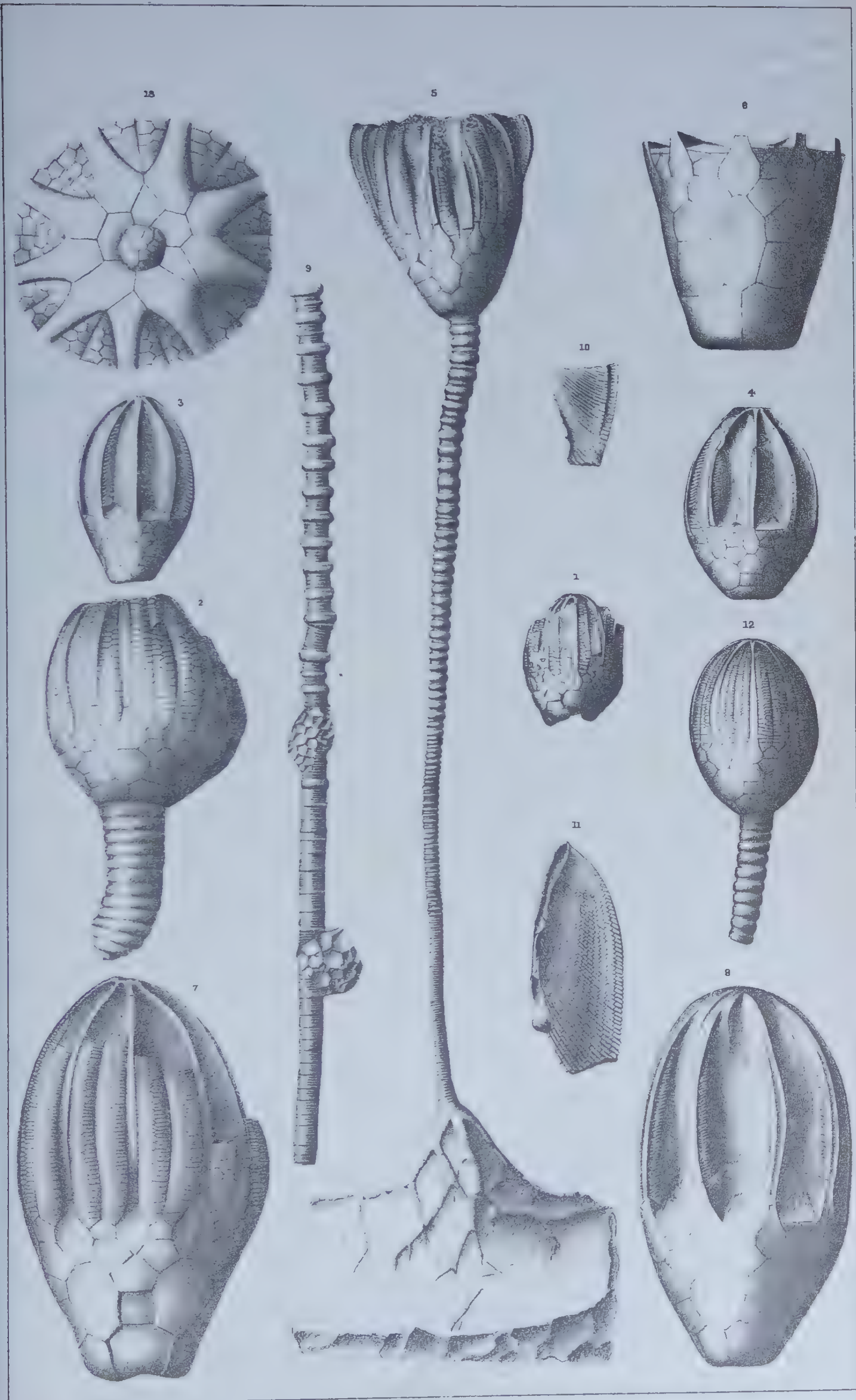

13
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PLATE XVIII.

EUCALYPTOCRINUS CRASSUS *Hall.*

Page 141.

Fig. 1. Lateral view of a large calyx, which is constricted below the middle.

Fig. 2. Lateral view of specimen without the constriction, with regularly sloping sides. This specimen preserves some of the lower plates of the arms.

Fig. 3. Basal view of the specimen fig. 1, showing the arrangement of plates and the deep cavity for the reception of the column, with the basal plates in the bottom.

Fig. 4. Lateral view of a large specimen, preserving the interbrachial plates, the spaces between which are filled with limestone.

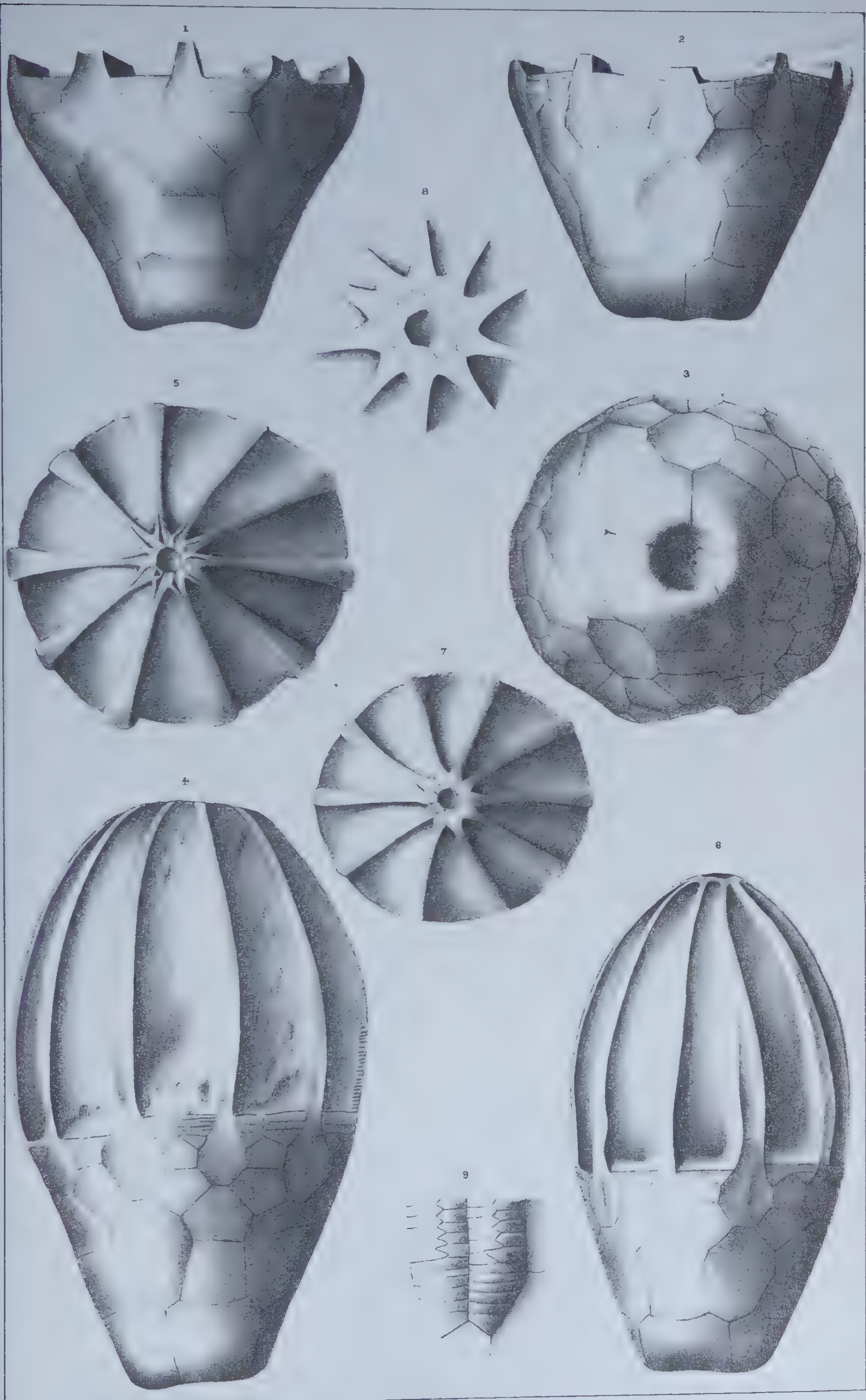
Fig. 5. The summit of the specimen fig. 4, showing lanceolate depressions in the upper ends of the interbrachials apparently for the insertion of accessory plates.

Fig. 6. Lateral view of a smaller specimen, which is more pointed at the upper end, but otherwise retaining the characters of this species.

Fig. 7. The summit of the preceding specimen, showing but two intercalated plates around the aperture.

Fig. 8. An enlargement from the summit of another individual, showing four intercalated plates.

Fig. 9. An enlargement of the bases of a pair of arms, and of the adjacen plates, from fig. 7, Plate 17, to show their arrangement.



G.B. Simpson, del.

PLATE XIX.

EUCALYPTOCRINUS CÆLATUS *Hall.*

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Fig. 1. The interior of the dome of a large imperfect specimen, showing the supraradial plates of adjacent rays, with the double interradial plate between them in the lower central part of the figure; also the arm-openings (the rhomboidal depressions) and the plates forming the lower part or sides of the dome. Above this is the dome covering the aperture which, in the lower part, is composed of four anchylosed plates, as farther shown in fig. 3. These are surmounted by a fluted hollow column, which reaches to the summit of the interbrachial plates. In this specimen it is broken off above. On the outer parts of the figure on either side may be seen the interbrachial plates, with the sutures dividing them from the inner parts.

Fig. 3. The lower concave surface of the anchylosed plates, which form the base of the dome over the visceral cavity of *Eucalyptocrinus cælatus.*

EUCALYPTOCRINUS CRASSUS *Hall.*

Page 141.

Fig 2. The upper rim of a flattened calyx of this species, showing the cicatrices for the attachment of the arms and interbrachial places.

Figs. 4, 5. The outer and inner surfaces of a lower dome plate of this species, showing it to be of much greater length than the corresponding part of *Eucalyptocrinus cælatus.*

Roots of EUCALYPTOCRINUS.

Page 144.

Figs. 6, 7. Upper and lateral views of a group of roots, which have grown upon the exterior of a calyx of *Eucalyptocrinus cælatus.*

Fig. 8. The upper side of a larger root with base of column, which has grown upon the surface of the calcareous mud of the sea bottom.

CALCEOCRINUS STIGMATUS *Hall.*

Page 147.

Fig. 9. Dorsal view of the body of a specimen enlarged to two diameters.

Fig. 10. Ventral side enlarged to two diameters, showing the scars for the attachment of the lateral and dorsal arms, and for the ventral plates.

Fig. 11. Lateral view of the same, enlarged.

NIAGARA GROUP.
(CRINOIDEA.)

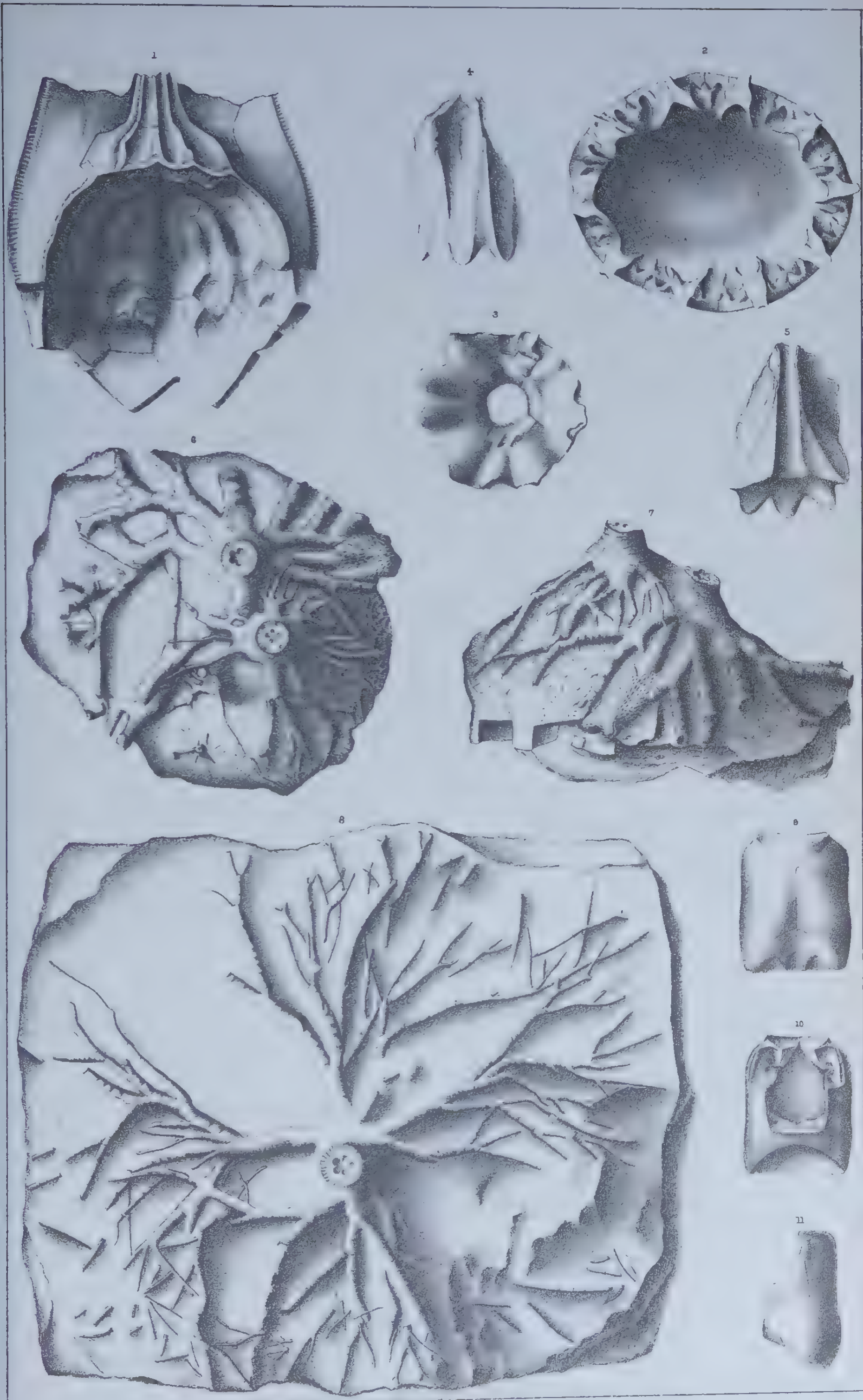

PLATE XX.

Roots of EUCALYPTOCRINUS.

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The specimen, which preserves the base of the column, shows the ramification of the rootlets through the calcareous shale, and was evidently imbedded during its growth upon the ocean bed.

Specimens sometimes occur with rootlets much more extended, and becoming quite filiform, but seldom traceable to their entire extent.

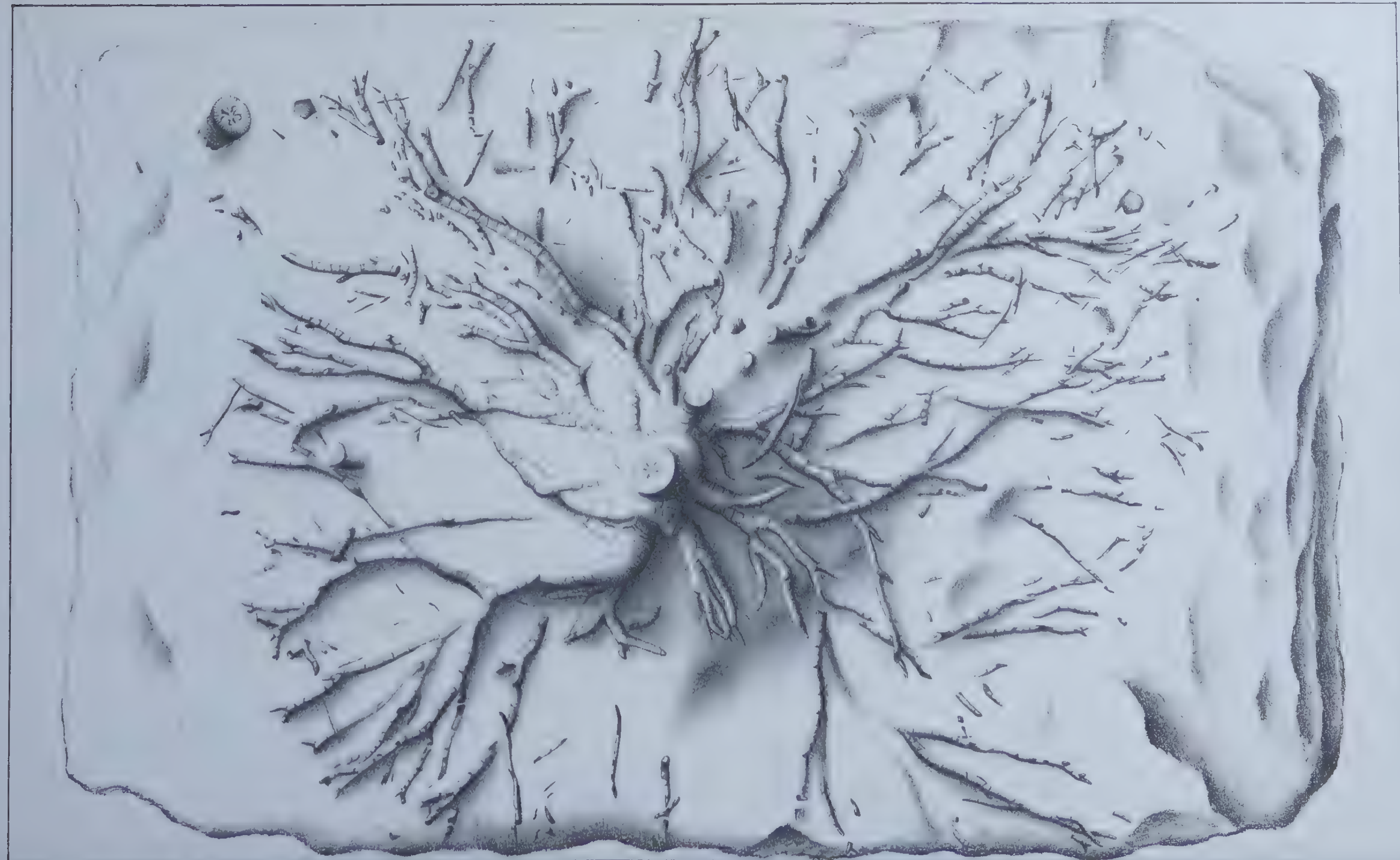

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PLATE XXI.

Pholidops ovalis *Hall.*

Page 149.

Figs. 1, 2. The upper valve and profile view (greatly enlarged) of a specimen retaining both valves.

Crania Siluriana *Hall.*

Page 148.

Fig. 3. A specimen which retains both valves, attached to the surface of Spirifera.

Fig. 4. The upper valve of a specimen attached to the surface of *Platyostoma Niagarense.* Owing to the contour of the surface on which it has grown, the shell has become elongated and constricted on one side.

Fig. 5. A lateral view of the same, showing the elevation.

Fig. 6. The calyx of *Eucalyptocrinus crassus* with four ventral valves of the species attached.

Fig. 7. A specimen of *Rhynchonella Stricklandi* with a ventral valve of the species attached.

Crania setifera *Hall.*

Page 148.

Fig. 8. A specimen which is imperfect around the margin, but shows the general features of the species.

Fig. 9. A lateral view of the same, restored on the edge, showing the elevation of the valve and the position of the apex.

Fig. 10. An enlargement of the surface to show the setiform spines.

Orthis elegantula *Dalman.*

Page 150.

Figs. 11, 12. Ventral and dorsal views of a small specimen.

Fig. 13. Ventral view of a large individual.

Fig. 14. Lateral view of a similar specimen.

Fig. 15. Interior of a large ventral valve, showing the cardinal area, teeth and wide foramen.

Fig. 16. An enlargement to two diameters of the interior of a dorsal valve, showing the muscular imprints, cardinal and crural processes, and external cardinal area.

Fig. 17. Cardinal view of the specimen fig. 14.

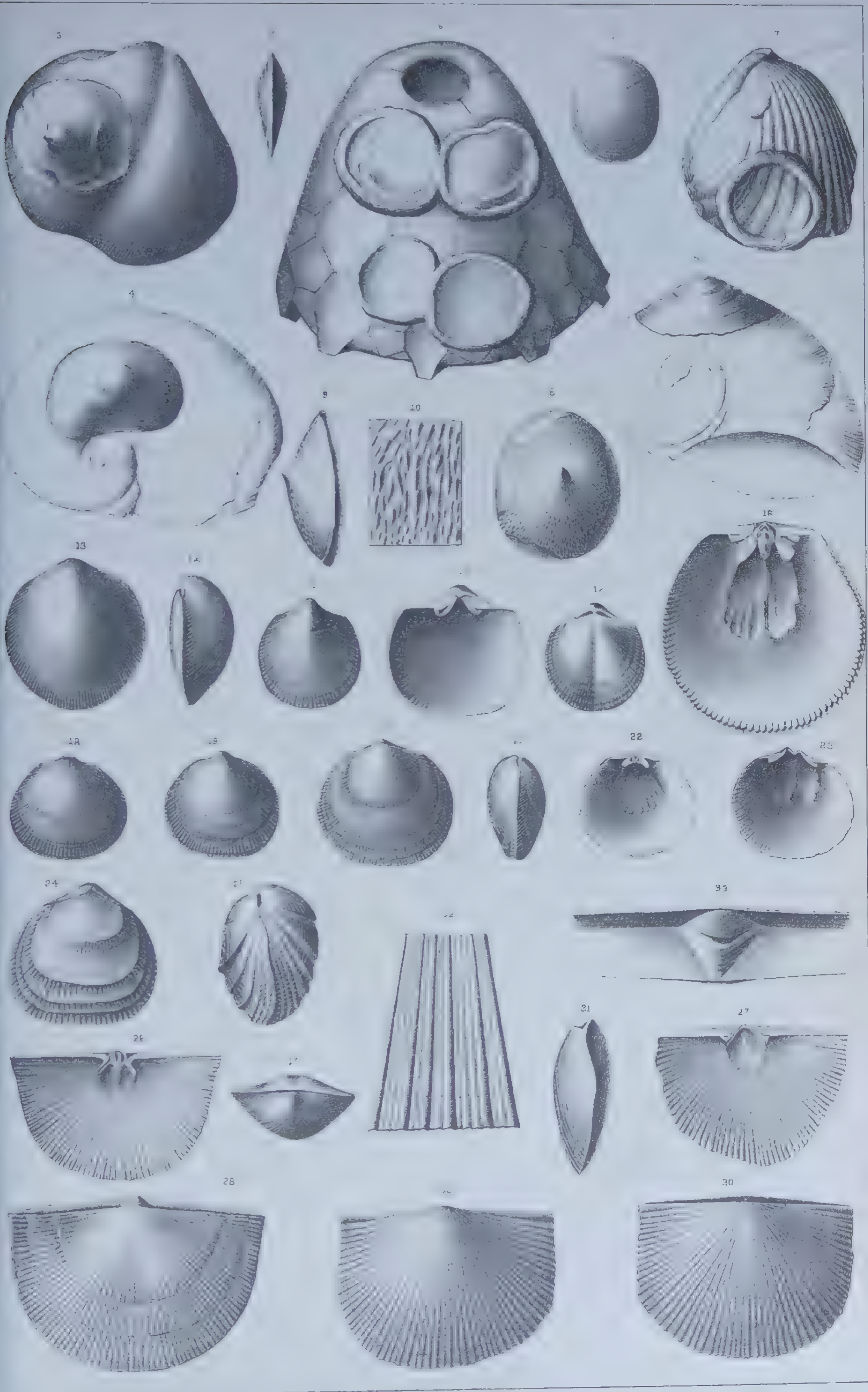

PLATE XXI — (*Continued*).

ORTHIS HYBRIDA *Sowerby*.

Page 149.

Fig. 18. Dorsal view of a specimen of the usual form and size.

Fig. 19. Ventral view of the same.

Fig. 20. Dorsal view of an unusually large specimen.

Fig. 21. Lateral view of the specimen figures 18 and 19, showing the relative convexity of the valves.

Fig. 22. The interior of a dorsal valve, showing the muscular impression, cardinal process, etc.

Fig. 23. The interior of a ventral valve, showing muscular imprints, teeth, etc. The shell is slightly distorted and imperfect on the cardinal margin.

Figs. 24, 25. Dorsal and lateral views of a small rotund specimen, showing strong varices of growth; enlarged to two diameters.

STREPTORHYNCHUS SUBPLANA (*Conrad*).

Page 151.

Fig. 26. The interior of a dorsal valve, showing the cardinal process, etc.

Fig. 27. An imperfect ventral valve, showing muscular imprints, teeth and cardinal area.

Fig. 28. Dorsal view of a symmetrical specimen of the larger size.

Figs. 29, 30. Ventral and dorsal views of a specimen of the usual size of the species as it occurs at Waldron.

Fig. 31. Ventral view of the same, showing the convexity of the valves.

Fig. 32. An enlargement of the surface, showing the fine concentric striæ.

Fig. 33. An enlargement of the central part of the cardinal area of the united valves, showing the closed deltidium, the striæ, etc.

PLATE XXII.

STROPHONELLA SEMIFASCIATA *Hall.*

Page 154.

Fig. 1. An imperfect dorsal valve.

Fig. 2. A more nearly entire specimen of the same valve, which presents the usual fasciculate characters of surface-striæ.

Fig. 3. Cardinal view of a specimen, retaining both valves in place and showing strong deltidial coverings.

STROPHOMENA RHOMBOIDALIS (*Wilckens*).

Page 150.

Fig. 4. The interior of a ventral valve, showing the muscular imprint.

Fig. 5. The dorsal view of a specimen, having both valves in connection.

Fig. 6. The ventral valve of the same.

Fig. 7. A lateral view of another specimen, with a ventral valve of *Crania Siluriana* attached.

Fig. 8. The upper part of a ventral valve of a large specimen, which preserves both valves, the cardinal line being shown near the lateral angles.

Fig. 9. The interior of a dorsal valve, showing muscular imprints, cardinal process, etc.

Fig. 10. An enlargement of the middle portion of the cardinal area of a specimen, with both valves in place, showing the back of the cardinal process of the dorsal valve filling the deltidial opening of the ventral valve. The central groove marks the division of the cardinal process.

CHONETES NOVA-SCOTICA *Hall.*

Page 155.

Fig. 11. A ventral valve showing the spines and the larger median striæ; enlarged to two diameters.

Figs. 12, 13. Two other ventral valves, natural size, showing the cardinal spines. The central part of these three figures is incorrectly represented as angular, instead of simply by a stronger median ray.

Fig. 14. An enlargement from the middle of a specimen to show the stronger central ray and fine concentric striæ.

CHONETES UNDULATA *n. sp.*

Page 155.

Fig. 15. An enlargement to four diameters of an individual possessing the usual characters.

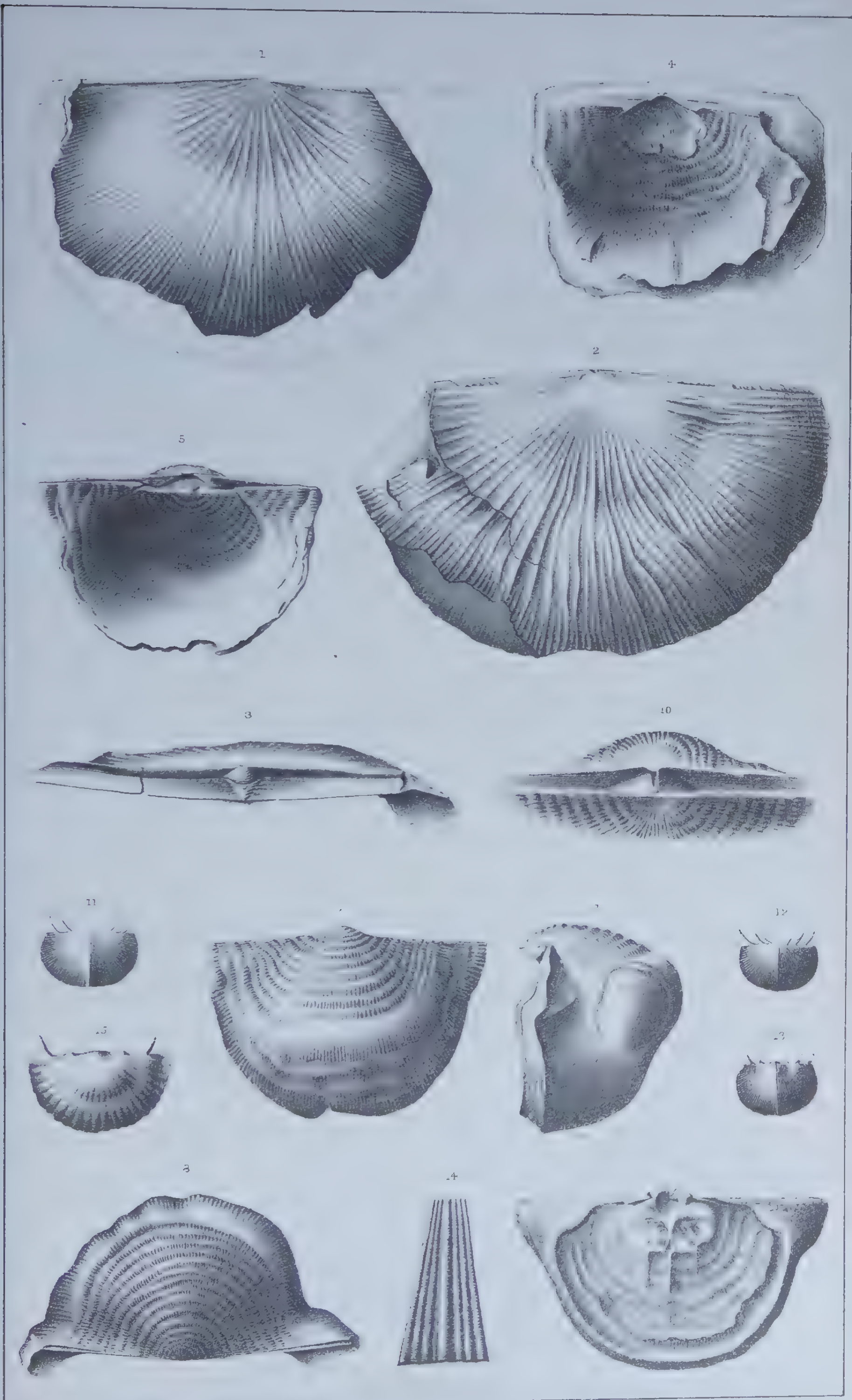

PLATE XXIII.

STROPHODONTA STRIATA *Hall.*

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Fig. 1. A ventral valve showing the general form and the surface characters.

Fig. 2. The dorsal side of the same.

Fig. 3. A profile view, showing the relative convexity and the bending of the valves at the cardinal angles.

Fig. 4. The interior of a dorsal valve, showing the cardinal process, and crenulate margins.

Fig. 5. The interior of a ventral valve, showing the muscular imprint, the cardinal area and the crenulations on the hinge.

Fig. 6. An enlargement of the cardinal process of the dorsal valve, showing the grooving of the posterior face.

STROPHONELLA SEMIFASCIATA *Hall.*

Page 154.

Fig. 7. The ventral side of a large, nearly entire specimen.

Fig. 8. The interior of an imperfect dorsal valve, referred with doubt to this species, showing a minute cardinal process and crenulated hinge line.

STROPHODONTA PROFUNDA *Hall.*

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Fig. 9. The interior of a ventral valve, showing the muscular imprint and cardinal area, with the hinge crenulations extending less than half its length.

Fig. 10. The exterior of an imperfect valve partially restored, showing the character of the striæ.

STREPTORHYNCHUS TENUIS *Hall.*

Page 150.

Fig. 11. An imperfect ventral valve, showing the rounded hinge extremity and the character of the surface-striæ.

Fig. 12. A dorsal valve showing the form of the shell.

Fig. 13. An enlargement of the surface, showing the alternations of the radiating striæ and the finer concentric crenulating lines.

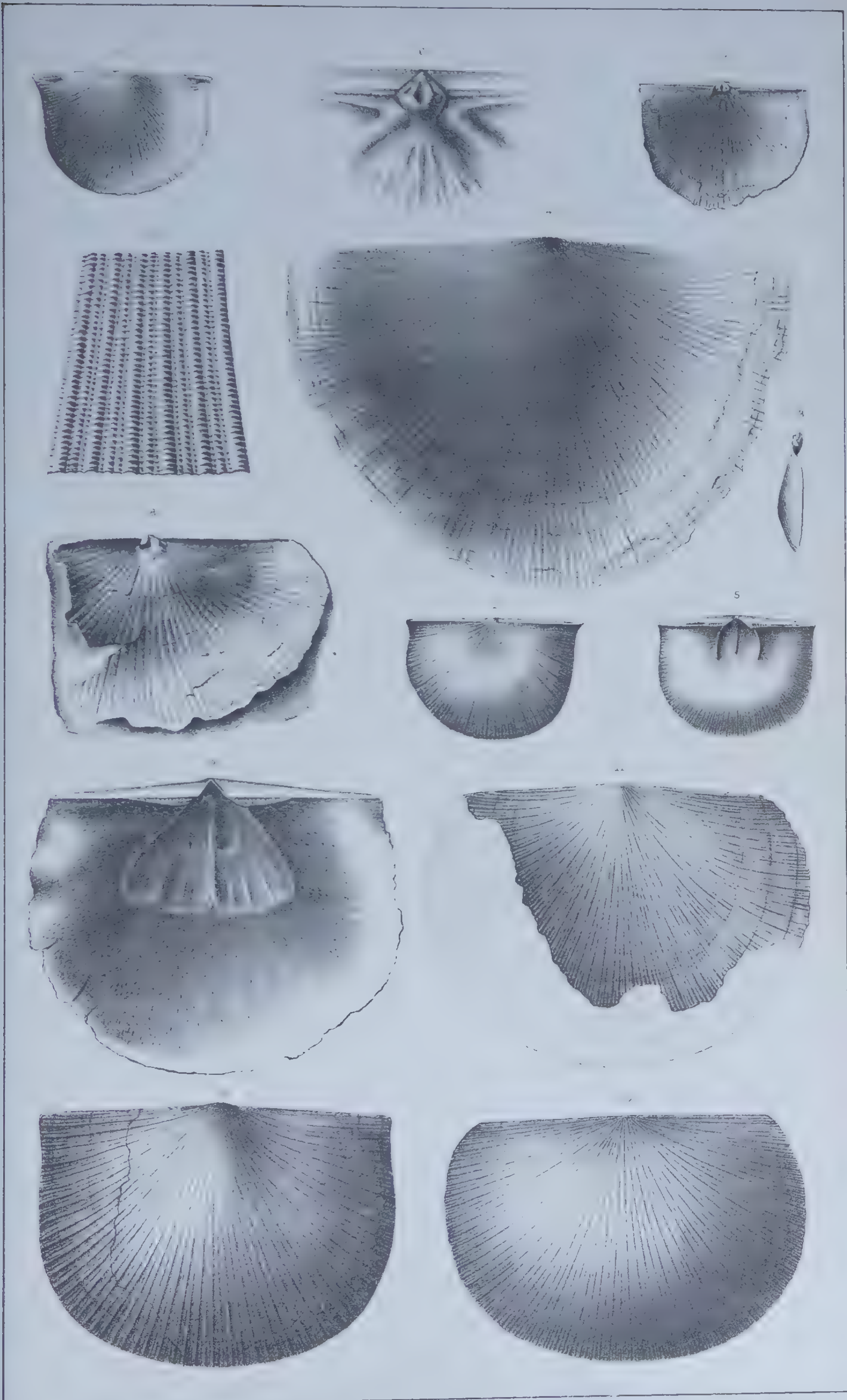

PLATE XXIV.

SPIRIFERA CRISPA (*Hisinger*) *var.* SIMPLEX *n. var.*

Page 157.

Figs. 1–5. Dorsal, ventral, front, lateral and cardinal views of a specimen of this variety, enlarged to two diameters.

SPIRIFERA CRISPA (*Hisinger*).

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Fig. 6. Dorsal view of a specimen of the size and form usually obtained at this locality.

Fig. 7. Ventral view of a wider form.

Figs. 8–12. Dorsal, ventral, front, cardinal and lateral views of a larger specimen showing the characters of the species, as it occurs at Waldron.

Fig. 19. The interior of a ventral valve, enlarged to two diameters.

SPIRIFERA EUDORA *Hall.*

Page 156.

Figs. 13–16. Dorsal, cardinal, front and lateral views of a specimen, presenting the features of the species from the Waldron locality.

Fig. 17. A ventral valve, having the surface-striæ strongly marked.

Fig. 18. Interior of a ventral valve, showing the cardinal area, the foramen and teeth.

SPIRIFERA RADIATA *Sowerby.*

Page 157.

Fig. 20. Dorsal view of a specimen of medium size.

Fig. 21. Dorsal view of a nearly full-grown specimen.

Figs. 22–26. Dorsal, ventral, cardinal, lateral and front views of a large well-formed specimen, of the usual characters of the species as recognized at this locality.

Fig. 27. Profile view of the specimen fig. 21, for comparison with fig. 25.

Fig. 28. The interior of a ventral valve.

Fig. 29. The interior of the cardinal portion of a dorsal valve.

Fig. 30. An enlargement of the surface-striæ. Figs. 17, 19, 22, 28, 29 and 30 are copied from Pal. N. Y., Vol. IV, Pt. II: *Revision of the Brachiopoda* (unpublished).

State Mus. Nat. Hist. 28

NIAGARA GROUP.

(BRACHIOPODA.)

Plate 24

PLATE XXV.

Meristina nitida *Hall.*

Page 160.

Fig. 1. Dorsal view of a small specimen of a rounded form.

Fig. 2. Ventral view of a rhomboidal specimen which is emarginate in front.

Fig. 3. Dorsal view of a large, broadly ovate form, which is emarginate in front and shows the foramen in the beak.

Fig. 4. Ventral view of a large rhomboid-ovate specimen, which is strongly emarginate in front.

Fig. 5. Lateral view of the specimen fig. 3, showing the convexity of the valves.

Fig. 6. Dorsal view of a narrow, elongate-ovate form, with a slight emargination in front.

Fig. 7. Dorsal view of a narrow, rhomboidal form, which is not emarginate.

Figs. 3, 5, 6 and 7 are copied from Pal., N. Y., Vol. IV, Pt. II: *Revision of the Brachiopoda*, (unpublished).

Meristina Maria *Hall.*

Page 159.

Fig. 8. Dorsal view of a young specimen which has not begun to develop the mesial elevation or sinus, and is proportionally broader than the mature, full-grown specimens.

Figs. 9, 10. Dorsal and front views of a large mature specimen.

Fig. 11. Front view of a specimen with the mesial fold much less strongly marked than fig. 10.

Fig. 12. Lateral view of the specimen fig. 9.

Retzia evax *Hall.*

Page 160.

Figs. 13–17. Dorsal views of specimens varying in size and form, and exhibiting some of the phases which mark the species in its advanced stages of growth.

Fig. 18. Profile of the specimen fig. 14, showing the convexity of the valves.

Fig. 19. Ventral view of a specimen showing the mesial depression.

Fig. 20. Front view of the specimen figs. 14 and 18, showing the depth of the depression.

Fig. 21. Ventral view of a small, elongate form, showing finer plications — apparently a mature specimen.

Nucleospira pisiformis *Hall.*

Page 160.

Figs. 22–25. Dorsal, ventral, lateral and cardinal views of a ventricose specimen, having much the appearance of *N. ventricosa* of the Lower Helderberg group.

PLATE XXV — (*Continued*).

Figs. 26, 27. Dorsal and lateral views of a less ventricose specimen, with surface almost entirely covered by fine setæ.

Fig. 28. Dorsal view of a specimen with more prominent beak.

RHYNCHOTRETA CUNEATA (*Dalman*) *var.* AMERICANA *n. var.*

Page 167.

Fig. 29. Dorsal valve of a small specimen of the usual form.

Fig. 30. Dorsal view of a more elongate form.

Figs. 31, 32. Dorsal and ventral views of a very broad specimen, having strong, slightly rounded plications.

Fig. 33. Ventral view of a large specimen, differing somewhat in form from the preceding.

Fig. 34. Lateral view of the specimen figs. 31 and 32.

Fig. 35. Dorsal valve of an extremely elongate form, with narrow plications.

Figs. 36, 37. Front views of the specimens fig. 33 and fig. 31, showing the elevation of the front.

Fig. 38. Dorsal view of a young shell before the development of the elevation of the front and depression of the sides has commenced.

CŒLOSPIRA DISPARILIS *Hall.*

Page 162.

Figs. 39–41. Dorsal, ventral and lateral views of a specimen, enlarged to two diameters, showing the usual characters of the species.

Fig. 42. An enlargement of a ventral valve of a specimen of more elongate form and extended beak.

Fig. 43. An enlargement of the dorsal side of a broader specimen. The apex of the dorsal valve is represented a little too convex.

ATRYPA RETICULARIS (*Linn.*).

Page 162.

Figs. 44, 45. Dorsal and ventral views of a specimen showing strong lamellæ fringing the concentric lines of growth.

Fig. 46. Ventral view of a larger and more ventricose specimen, with finer concentric markings.

Fig. 47. Lateral view of the same, showing the convexity of the valves.

PLATE XXVI.

Rhynchonella neglecta *Hall.*

Page 162.

Figs. 1, 2. Dorsal and front views of a specimen of the usual size.

Figs. 3–6. Dorsal, ventral, lateral and front views of a larger specimen.

Rhynchonella acinus *Hall.*

Page 163.

Fig. 7. The dorsal side of a specimen of regularly ovate form, enlarged to four diameters.

Figs. 8–11. Dorsal, front, ventral and lateral views of a somewhat larger specimen, similarly enlarged, showing the usual features of the species.

Rhynchonella Indianensis *Hall.*

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Fig. 12. Dorsal view of a small specimen.

Figs. 13, 14. Dorsal and ventral views of a larger specimen, having three plications elevated on the dorsal fold.

Figs. 15, 16. Corresponding views of a specimen with four plications elevated on the dorsal fold.

Figs. 17, 18. The dorsal and ventral sides of a smaller specimen, having four plications on the fold.

Fig. 19. Lateral view of the specimen fig. 15.

Fig. 20. Lateral view of the specimen fig. 17.

Figs. 21, 22. Front views of the specimens figs. 15 and 17.

Rhynchonella Whitii *Hall.*

Page 164.

Figs. 23–26. Dorsal, ventral, front and lateral views of a characteristic specimen of this species, having but two plications elevated in the center.

Figs. 27–29. Dorsal, ventral and front views of a specimen with one of the median plications divided, making three elevated on the mesial fold.

Figs. 30–33. Front, lateral, dorsal and ventral views of a specimen, showing four elevated plications on the mesial fold.

Rhynchonella Stricklandi (*Sowerby*).

Page 165.

Figs. 34, 35. Dorsal and ventral views of a specimen of the more finely plicated variety.

Fig. 36. Dorsal view of a specimen with coarser plications.

Fig. 37. Lateral view of the specimen fig. 34.

Fig. 38. Front view of the preceding, showing the narrower form of the mesial elevation.

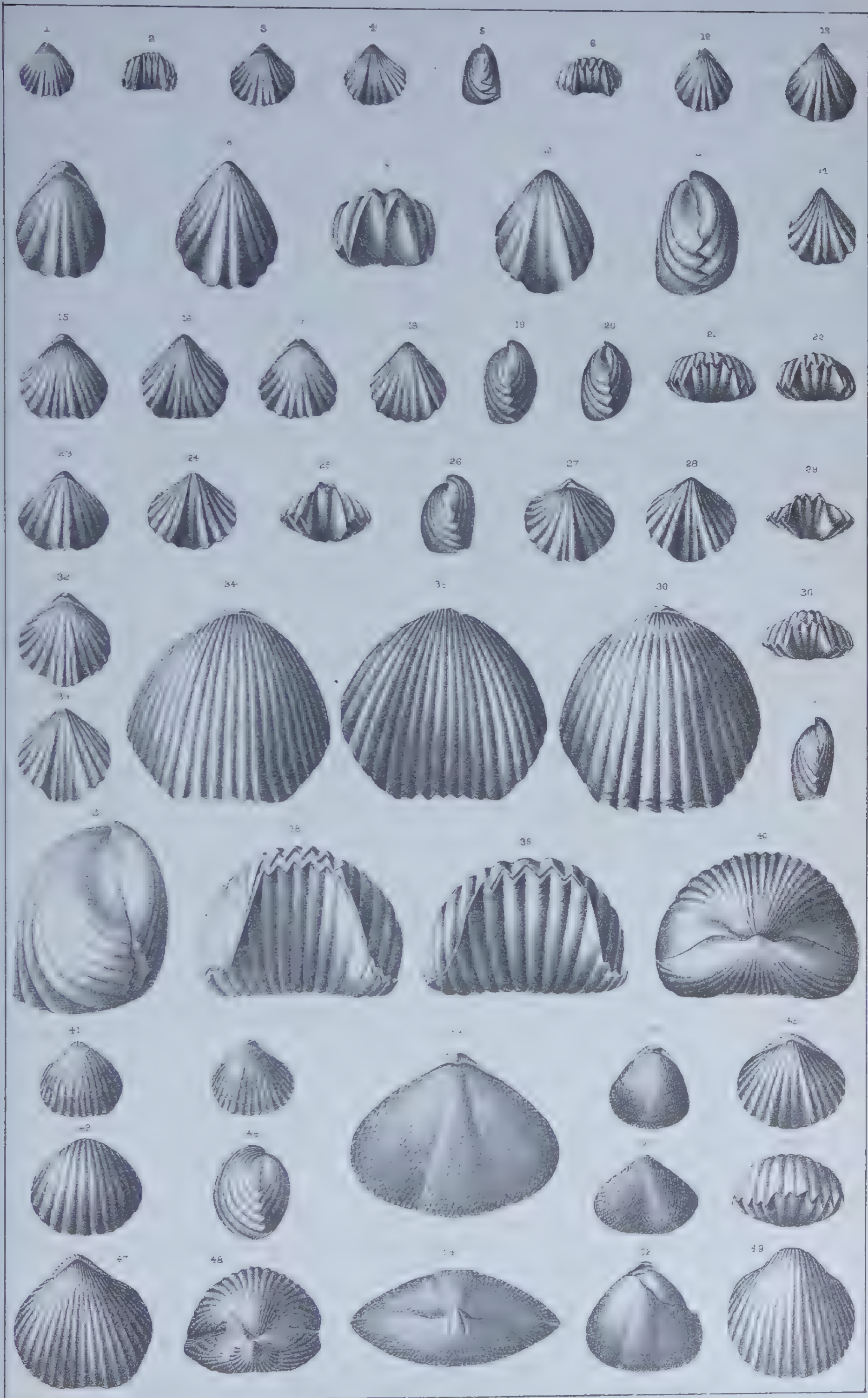


PLATE XXVI.—(*Continued*).

Fig. 39. Front view of the specimen fig. 36, showing a broader elevation than the last figure.

Fig. 40. Cardinal view of the more finely plicated variety.

ANASTROPHIA INTERNASCENS *n. sp.*

Page 168.

Figs. 41, 42. Ventral and dorsal views of a small specimen, more finely plicated than usual.

Figs. 43–46. Ventral, lateral, dorsal and front views of a specimen of medium size, having coarse plications.

Figs. 47–49. Dorsal, cardinal and ventral views of a specimen of the usual character.

EICHWALDIA RETICULATA *Hall.*

Page 169.

Fig. 50. Dorsal valve of a narrow, elongate form, with a scarcely distinguishable mesial fold.

Fig. 51. Ventral side of a larger and more transverse specimen, showing a distinct mesial depression.

Fig. 52. A large imperfect specimen, intermediate in form between the two preceding, and with more distinctly defined mesial fold.

Figs. 53, 54. Dorsal and cardinal views of a specimen similar to fig. 51, enlarged, showing the surface characters, and (on the latter figure) the denuded space on the beak of the ventral valve, corresponding to the foramen in other genera.

These figures are copied from the *Twentieth Report on the State Cabinet of Natural History*, page 275, and from *Pal. N. Y.*, Vol. IV, Part II (unpublished).

PLATE XXVII.

Amphicœlia Leidyi *Hall.*

Page 171.

Fig. 1. An imperfect left valve.

Fig. 2. An imperfect right valve, which presents some difference in the form and position of the beak; probably indicating a distinct species.

Modiolopsis perlatus *Hall.*

Page 172.

Fig. 3. A right valve characteristic of the species.

Fig. 4. Cardinal view of the same, showing the convexity of the valve.

Modiolopsis subalatus *Hall.*

Page 173.

Fig. 5. The left valve of a form closely resembling the *M. subalatus* of New York, but of larger dimensions.

Fig. 6. A right valve, having a proportionally greater length—in this feature more nearly approaching the New York specimens.

Pterinea brisa *Hall.*

Page 173.

Fig. 7. The exterior of a small, imperfect left valve, with well-preserved surface characters.

Fig. 8. The interior of a large imperfect left valve.

Fig. 9. An internal cast of a small left valve.

Mytilarca sigilla *Hall.*

Page 174.

Fig. 10. A small right valve of a specimen of this species.

Ambonychia acutirostra *Hall.*

Page 171.

See plate 7, fig. 12, under description of *Sagenella elegans.*

Orthoceras simulator *Hall.*

Page 179.

Fig. 11. A fragment of the septate portion of a specimen, showing its general form and character.

Fig. 12. A smaller fragment, similar to the last, but apparently retaining the exterior shell over a portion of the tube.

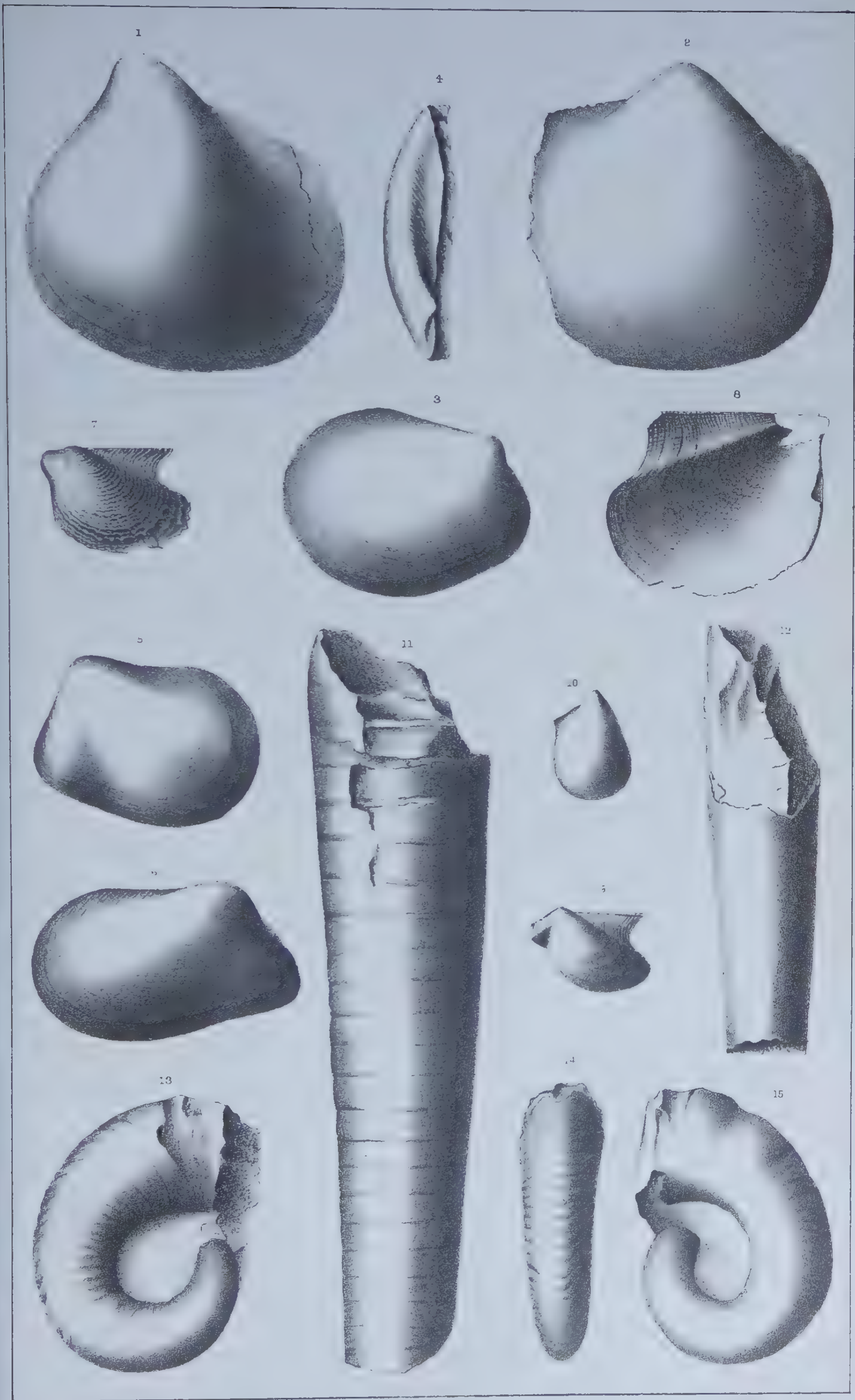
Trochoceras Waldronense *Hall.*

Page 179.

Fig. 13. Lateral view of a specimen preserving one volution, and showing the annulations, but no septa.

Fig. 14. Ventral view of the same, showing the compressed condition of the specimen, and the sinus in the annulations on the ventral side.

Fig. 15. Lateral view of a specimen preserving about the same extent of the tube, with the annulations less distinct, and showing no septa.



G. B. Simpson, del.

PLATE XXVIII.

Platyostoma Niagarense *Hall.*

Page 175.

Fig. 1. A small specimen, showing strong revolving striæ and with a slight depression on the upper surface of the last volution.

Figs. 2–4. Basal, summit and lateral views of a specimen similarly striated, which is sulcated above and below, with two distinct folds on the lower surface of the volution.

Figs. 5–7. Three views of a larger, loosely coiled specimen, with a distinct sulcation above and below the middle of the volution.

Figs. 8, 9. Two views of a more ventricose specimen with regularly convex volutions.

Figs. 10, 11. The summit and ventral view of a large loosely coiled specimen, the outer volution being free.

Fig. 12. The spire of a large ventricose specimen, with closely coiled volutions.

Platyostoma Niagarense?

Fig. 13. A specimen with its aperture showing a twisted inner lip of the peristome. This feature is produced by the folds on the inner part of the volution and is not a true columella.

Platyostoma plebium *Hall.*

Page 175.

Figs. 14, 15. The opposite sides of a specimen, showing the height of the spire and form of the volution and aperture.

NIAGARA GROUP.

(GASTEROPODA.)

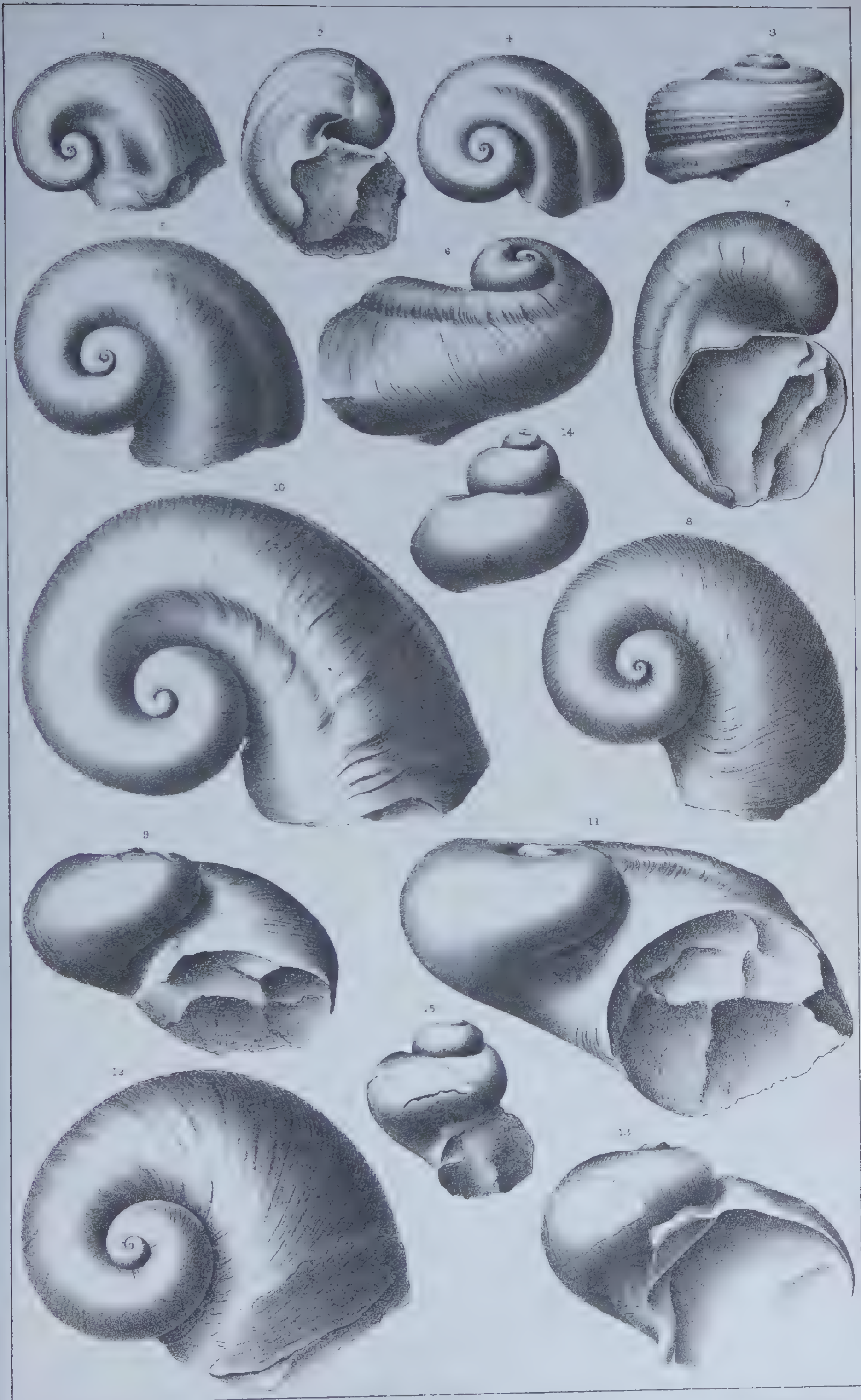


PLATE XXIX.

Platyostoma Niagarense *Hall.*

Page 175.

Figs. 1–4. Four views of a specimen of medium size, where the inner lip of the peristome unites with the surface of the preceding volution, with the spire rising but little above the level of the outer part of the shell.

Fig. 5. The aperture of a specimen having the spire flat or slightly depressed, and the peristome spreading upon, and conforming to, the shape of the preceding volution.

Fig. 6. The aperture of a larger specimen, with more rounded volutions and elevated spire, but having the peristome overlapping the preceding volution.

Figs. 7–10. Four views of a specimen with moderately elevated spire, sub-depressed volutions and slightly united peristome. In consequence of some accident during the early stages of growth, the inner part of the lower lip has become contracted, forming a deep and abrupt break in the margin, which has probably increased with the age of the shell; as shown in fig. 9.

Figs. 11–13. Front, dorsal and basal views of a slender, depressed specimen, with loosely coiled volutions, which become disunited and deflected.

Figs. 14, 15. The opposite sides of a large ventricose specimen, with rapidly increasing volutions — the last one becoming disunited and deflected, presenting a very peculiar character, and wide contrast with other forms.

G. B. Simpson, del.

PLATE XXX.

STROPHOSTYLUS CYCLOSTOMUS *Hall.*

Page 176.

Fig. 1. The back of a small specimen, showing the rotundity of the volutions and an unusually high spire.

Fig. 2. An oblique front view of a larger characteristic specimen, showing the obliquity of the aperture.

Figs. 3, 4. Summit and lateral views of a specimen of usual form and size.

Fig. 5. The aperture of a more elevated specimen, showing the character of the inner lip and columella.

Fig. 6. Dorsal view of a specimen with very rotund volutions.

Fig 7. The aperture of a more erect and elevated form, showing some slight differences from fig. 5.

Figs. 8 10. Dorsal, basal, and oblique front views of a large, perfect specimen, showing the direction of the striæ, the aperture, etc.

Figs. 11, 12. Front and oblique lateral views of a specimen showing the form of the aperture, inner lip, and twisting of the columella.

Fig. 13. An enlargement of the surface-striæ of a full-grown specimen, showing the transverse striæ of growth, and the finer revolving lines.

STROPHOSTYLUS CYCLOSTOMUS *var.* DISJUNCTUS *n. var.*

Page 177.

Figs. 14, 15. The opposite sides of a specimen referred with doubt to this species. The outer volution has become free, so that its generic characters are obliterated; but the surface-striæ and the upper volutions are precisely the same as *S. cyclostomus*.

CYRTOLITES SINUOSUS *Hall.*

Page 178.

Figs. 16 18. Lateral, front and dorsal views of a specimen enlarged to three diameters.

BELLEROPHON TUBER *Hall.*

Page 177.

Figs. 19, 20. Dorsal and lateral views of a specimen, enlarged to two diameters.

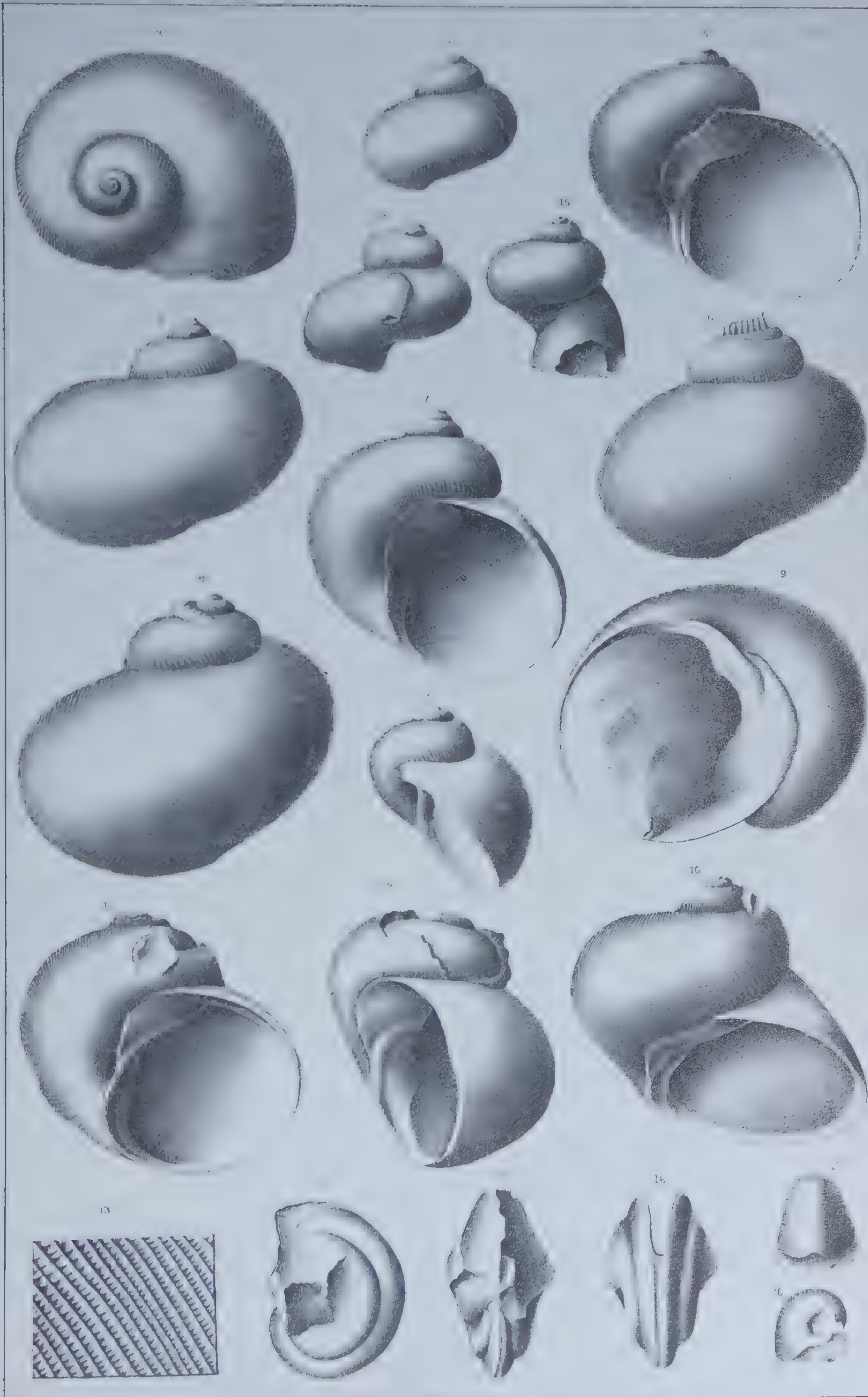


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PLATE XXXI.

CORNULITES PROPRIUS *Hall.*

Page 182.

Fig. 1. A group of young individuals attached to a young shell of *Strophostylus cyclostomus*, enlarged to two diameters. This group has the peculiarity of forming an irregular circle—the only instance of this kind observed.

Fig. 2. A large specimen attached to a shell of the same species as above.

Fig. 3. A group of three individuals of different sizes attached to the shell of *Platyostoma Niagarense.*

Fig. 4. Lateral view of a large specimen, showing the usual characters of the fully developed form.

Fig. 5. A smaller specimen which is attached to the side of the cup of *Eucalyptocrinus crassus.* The attached portion of the tube is flattened on the lower side and thickened above, and united by nearly its entire width to the crinoidal plates.

Fig. 6. A specimen of very irregular growth and strongly striated surface.

Fig. 7. Lateral view of a similar specimen, showing, as in the preceding, the repairs of injuries received during life.

Fig. 8. An enlargement of the surface, showing the character of the longitudinal striæ, and the abrupt change at one of the concentric ridges.

Fig. 9. A longitudinal section of a large imperfect specimen, showing the cellulose texture of the substance, and also the annulated character of the interior face of the tube.

Fig. 10. A longitudinal section of a large specimen, where the walls have been quite thin, showing the annulation of the inner surface and a thin coating of cellulose tissue, chiefly on one side.

Fig. 11. A transverse section of a specimen enlarged, showing the vesicular texture of the test.

Fig. 12. A still farther enlargement from the same specimen.

Fig. 13. An enlargement of a part of the left side of specimen fig. 9, near the middle of the length, showing the partial obliteration of the annulations, on the interior at this point, by the formation of vesicular tissue upon the inner face. This change is probably the result of thickening and contracting the space with the advancing age of the individual; the usual and almost invariable mode of increase being by exterior additions of tissue.

Forms like those represented in figures 1, 2 and 3 have sometimes been referred to Cornulites, Tentaculites, and to column bases of Cystidians. More recently Prof. Nicholson has proposed the names Ortonia and Conchicolites for similar forms. The absolute connection of these small annulated forms with the larger ones, like figures 4, 5, 6 and 7, has been demonstrated; and we find the smaller attached forms, where there has been a thickening of the exterior, and a partial obliteration of the regular annulations, giving the individuals the aspect of the bases of figures 4 and 5. Moreover, longitudinal sections of these small annulated forms show vesicular structures similar to the larger ones. In one example before me, the interior wall of the tube is

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Plate 31.

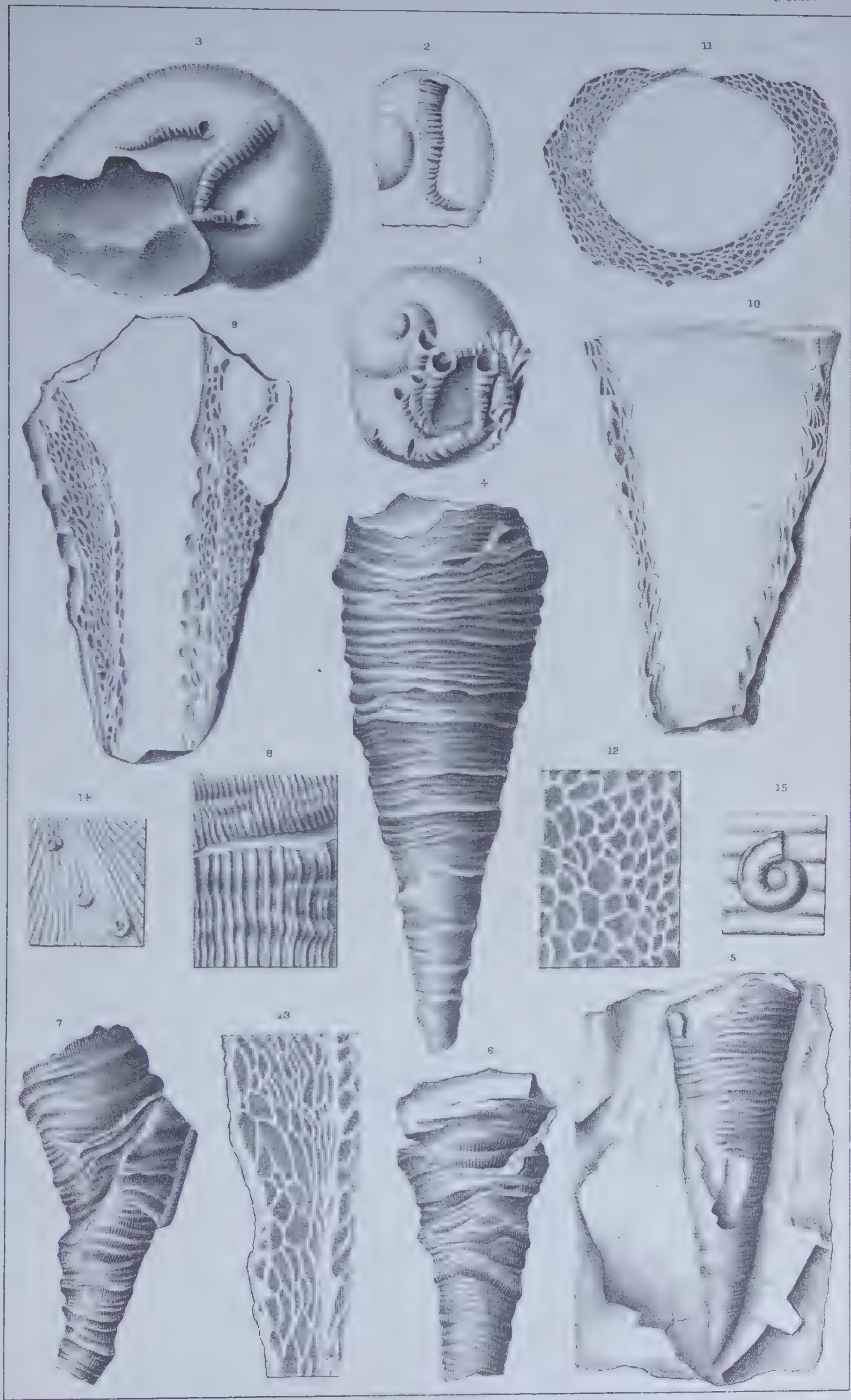

PLATE XXXI — (*Continued*).

well marked, with an exterior thickening of loose texture; and in another specimen, the inner wall is similarly well-defined, with an exterior thickening of the substance which is distinctly vesicular in structure.

SPIRORBIS INORNATUS *Hall*.

Page 181.

Fig. 14. A group of three specimens, natural size, attached to the surface of a *Strophomena*.

Fig. 15. A specimen enlarged, to show the character of the shell and the incipient annulations.

PLATE XXXII.

LEPERDITIA FABA *Hall.*

Page 186.

Fig. 1. The right side of a specimen greatly enlarged, showing the line of the hinge and the projection of the left valve above the right.

Fig. 2. Basal view of the same specimen, showing the convexity of the valves.

Fig. 3. The left side of a specimen, showing the overlapping of the valves at the base.

BEYRICHIA GRANULOSA *Hall.*

Page 186.

Fig. 4. An enlargement of a right valve with the dorsal margin incomplete, showing the general form and granulose surface. The granulae as represented are too regularly disposed.

CYPHASPIS CHRISTYI *Hall.*

Page 188.

Fig. 5. A separate head, imperfect on the eye-tubercles and the glabella; enlarged to two diameters.

Fig. 6. An entire individual, enlarged to two diameters.

Fig. 7. Profile of the same specimen, showing the elevation of the body, enlarged to correspond with the preceding figure.

CALYMENE NIAGARENSIS *Hall.*

Page 187.

Fig. 8. The upper surface of a large specimen, slightly distorted about the cephalic shield.

Fig. 9. The under side of the same, showing the hypostoma in place.

Fig. 10. The upper surface of a larger cephalic shield, showing nearly perfect eye-tubercles.

Figs. 11, 12. Front and lower side of the same specimen, showing the continuation of the facial sutures.

Fig. 13. A separated glabella and fixed cheeks.

Fig. 14. Profile of the specimen fig. 11.

Fig. 15. Profile of the specimen fig. 13, showing the line of the facial suture and elevation.

CERAURUS (CHIERURUS) NIAGARENSIS *Hall.*

Page 189.

Fig. 16. A nearly entire pygidium, showing its form and characters.

HOMALONOTUS DELPHINOCEPHALUS (*Green*).

Page 187.

Fig. 17. The upper surface of a fragment of a head, showing the characters as well as can be seen in any of the specimens known from this locality.

Fig. 18. An imperfect pygidium.

ILLÆNUS ARMATUS? *Hall.*

Page 189.

Fig. 19. An imperfect glabella.

Fig. 20. An imperfect pygidium, the anterior margin restored in outline at the right hand upper angle.

NIAGARA GROUP.

(CRUSTACEA.)

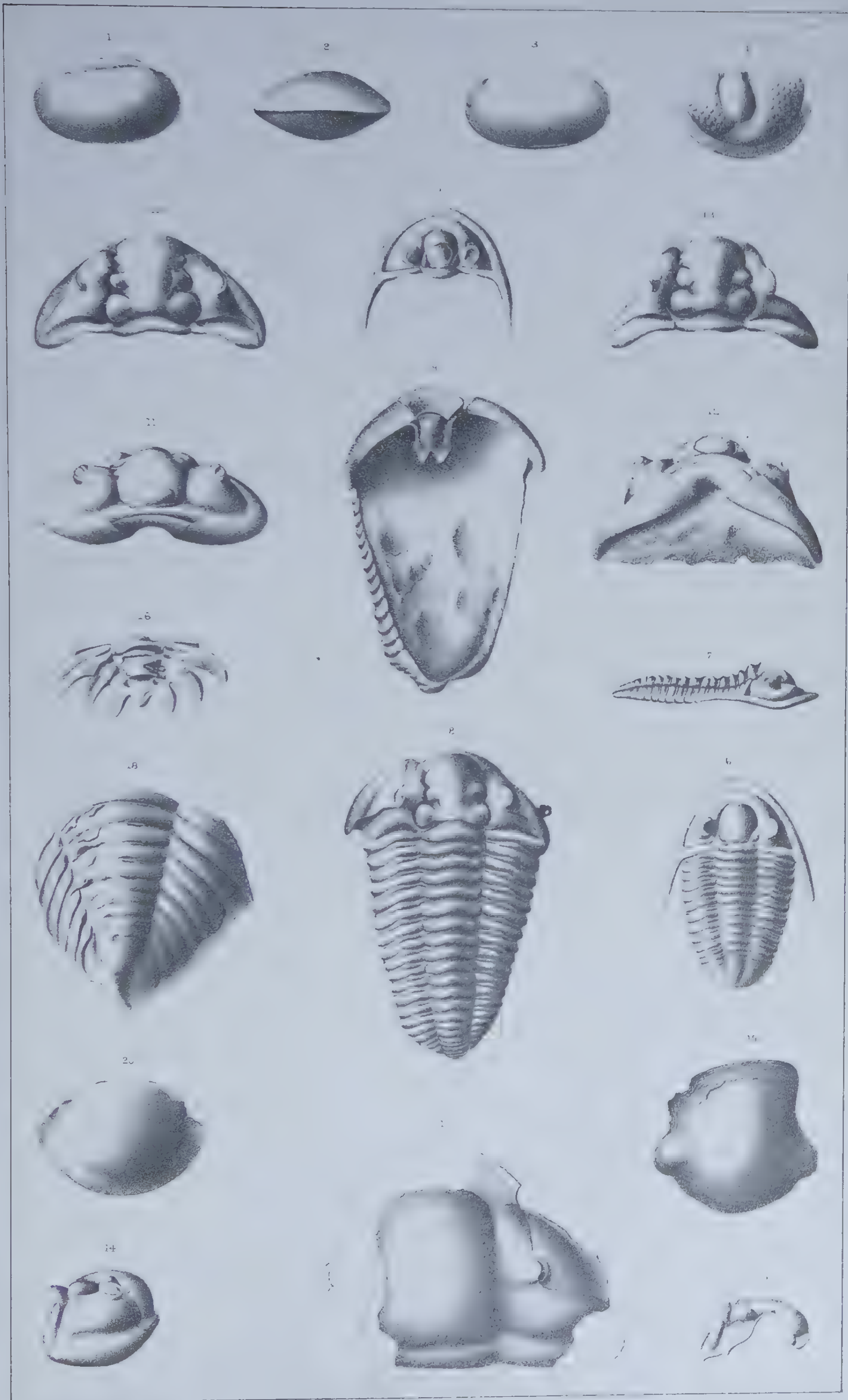

PLATE XXXIII.

Dalmanites vigilans *Hall.*

Page 193.

Fig. 1. The upper side of a cephalic shield, showing the characters observed on several individuals from this locality.

Fig. 2. The lower surface of the border of a head.

Figs. 3, 4. Two pygidia referred to the same species.

Dalmanites verrucosus *Hall.*

Page 195.

Fig. 5. A small head, having the usual character of this species.

Fig. 6. A larger head showing a slight spiniform node on the occipital ring.

Fig. 7. The dorsal surface of a large specimen, preserving the head and thorax entire, and the anterior part of the pygidium, with all their characteristic markings.

Fig. 8. A much larger imperfect head.

Fig. 9. Anterior view of a nearly perfect head, of somewhat more than the medium size, showing the anterior extension of the facial suture, on the left hand side of the figure.

Fig. 10. Lateral view of the same, showing the posterior extension of the facial suture.

Fig. 11. An enlargement of the eye.

Fig. 12. A profile view of a thoracic segment.

Figs. 13–15. The pygidia of three individuals, showing gradations in size.

Fig. 16. Profile of the specimen fig. 15, showing the elevation of the axis.

Fig. 17. A larger pygidium, which is remarkably straight on the anterior margin.

Dalmanites bicornis *Hall.*

Page 196.

Fig. 18. The lower surface of the marginal rim of the head, showing the anterior bifurcating process. No other parts of this species are known at the present time.

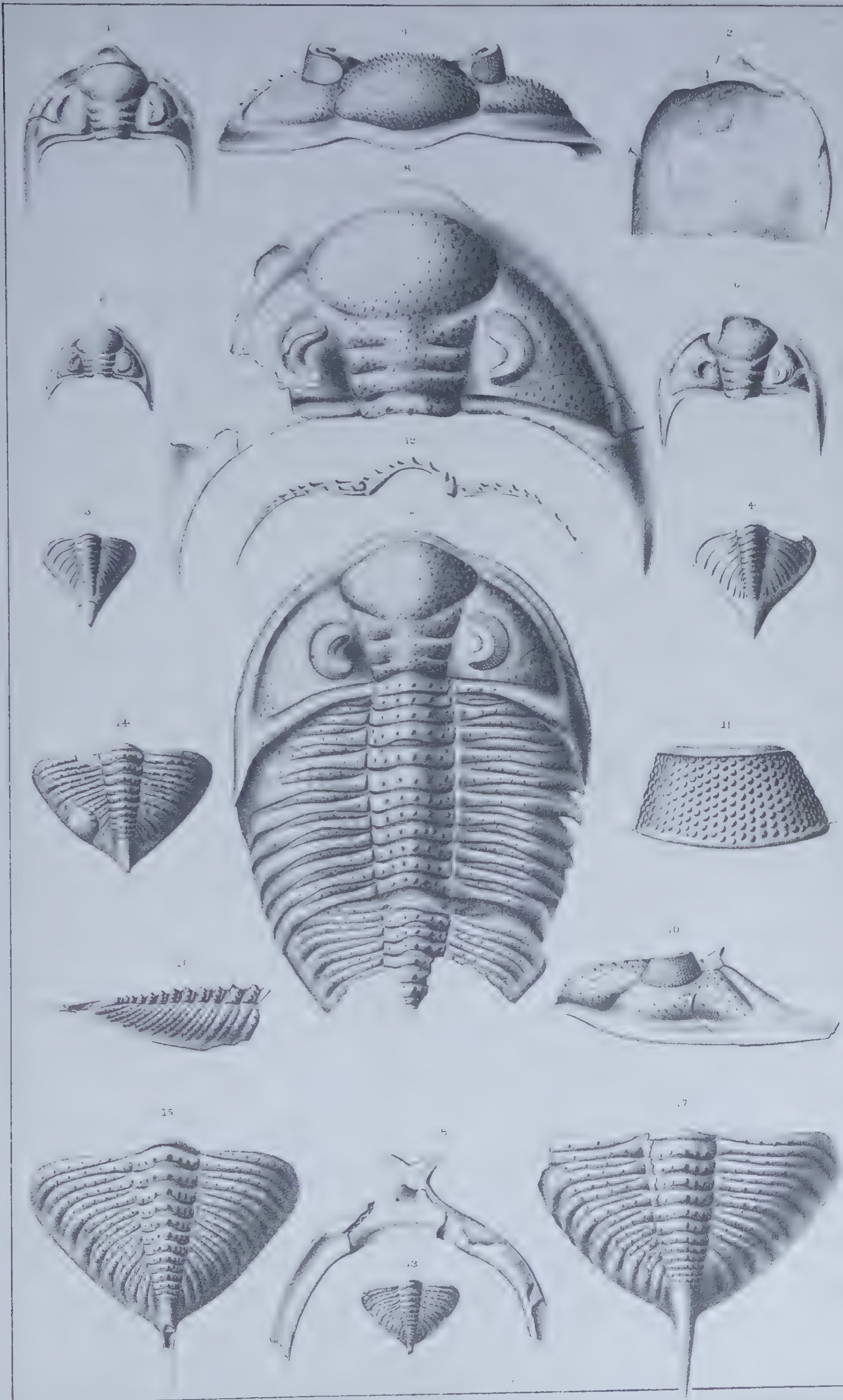

PLATE XXXIV.

LICHAS BREVICEPS *Hall.*

Page 197.

Fig. 1. The upper surface of an imperfect head; the typical form of the species.

Fig. 1 a. An enlargement of the surface of the glabella.

Fig. 2. Profile view of the same, showing the elevation of the glabellar lobe.

Fig. 3. An enlargement of the eye.

Fig. 4. An imperfect thorax and pygidium; the anterior part of the figure is restored in outline.

Fig. 5. The lower surface of a large imperfect pygidium, showing the striæ of the enfolded border.

Fig. 6. The upper surface of a smaller imperfect pygidium, restored in outline.

Fig. 7. The central portion of a large glabella; the outline is carried out to correspond with the specimen fig. 1.

LICHAS BOLTONI (*Bigsby*) *var.* OCCIDENTALIS *Hall.*

Page 198.

Fig. 8. The lower side of a large perfect pygidium, showing the broad inner lining of the border with its characteristic markings.

Fig. 9. The upper side of a smaller imperfect pygidium. The separation between the lobe of the axis and its continuation on the marginal expansion, is due to accidental pressure and partial distortion of the parts.

Fig. 10. The lower surface of a smaller pygidium, showing similar characters to fig. 8, except that it is more rounded on the posterior margin.

Fig. 11. The hypostoma of a specimen, probably of this variety, resembling those from the Niagara shale of New York.

LICHAS *sp.?*

Page 199.

Fig. 12. The anterior extension of a head of undetermined specific relations belonging to this genus.

DALMANITES VERRUCOSUS *Hall.*

Page 195.

Fig. 13. The lower surface of the marginal rim of the head, for comparison with fig. 2 of Pl. 33.

Fig. 14. The inner side of the crust of a pygidium, showing the points of attachment for natatory organs.*

Fig. 15. Profile view, looking across the elevation of these processes of attachment, and of the ridge corresponding to the dorsal furrow of the exterior.

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*See a paper in this Report, on the *Discovery of the Remains of Natatory and Branchial Appendages of Trilobites*, by C. D. Walcott.

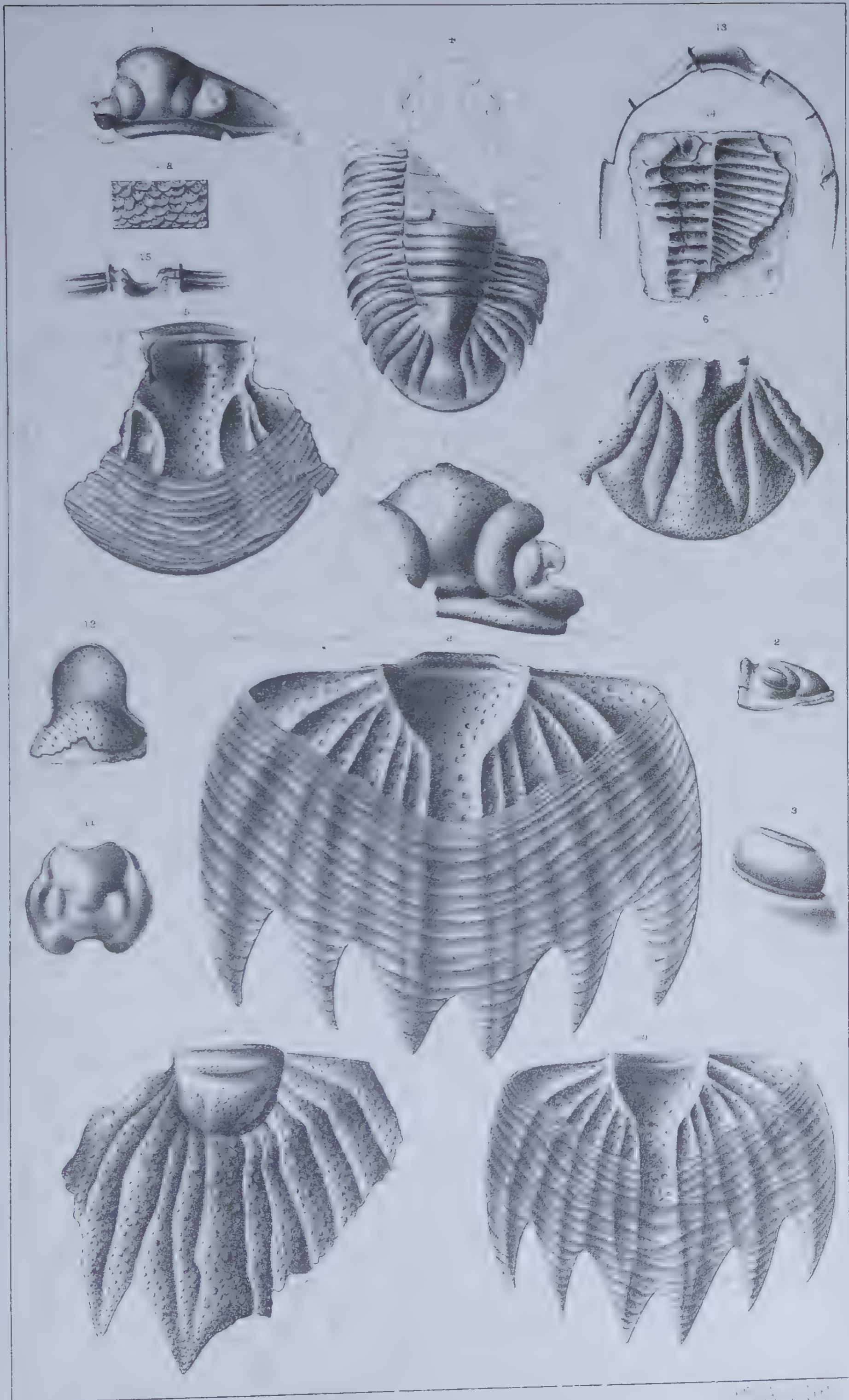

PLATE XXXV.

Camarocrinus stellatus.

Page 207.

Fig. 1. Basal view of a large individual, showing the form and lobation of the body and the structure of the base with the attachment for the column. The bifurcations of the basal branches indicate that there were ten ambulacral openings to the interior chambers.

Fig. 2. *Id.* Lateral view showing the elevation of the body, and the variolate surface, produced by the weathering of the exterior.

Fig. 3. The base of a smaller specimen with the form and lobation of the body shown in outline. The base of this specimen is comparatively a little larger than in the preceding one. The external structure is shown, and a portion of the stellate surface at the right hand side of the figure. The portion in outline shows the internal chambers of the same specimen.

Fig. 4. *Id.* A portion of the surface enlarged six diameters showing the stellate network forming the exterior walls of the chambers. At the junction of the numerous ramifications the rays are thickened and elevated into a distinct node.

Fig. 5. A vertical section of specimen, fig. 1, showing the vertical axis and horizontal partitions of the body. The chamber indicated by *c*, appears to be composed of solid plates, occupying a position immediately above the column attachment, and corresponding to the position of a calyx proper. The double character of the exterior chamber walls is also shown, with the infolding of the interior layer to form the partitions of the chambers.

Fig. 6. Horizontal section of the lower half of fig. 1, showing portions of two large chambers and two smaller intermediate chambers.

Fig. 7. A horizontal section of a small individual, divided into eight irregular chambers, and an obscure central cavity, by the vertical partitions.

Fig. 8. Horizontal section near the summit of another example, showing a division into four equal and symmetrical chambers.

The specimens of this species here illustrated are from the Tentaculite limestone, *Schoharie, N. Y.*

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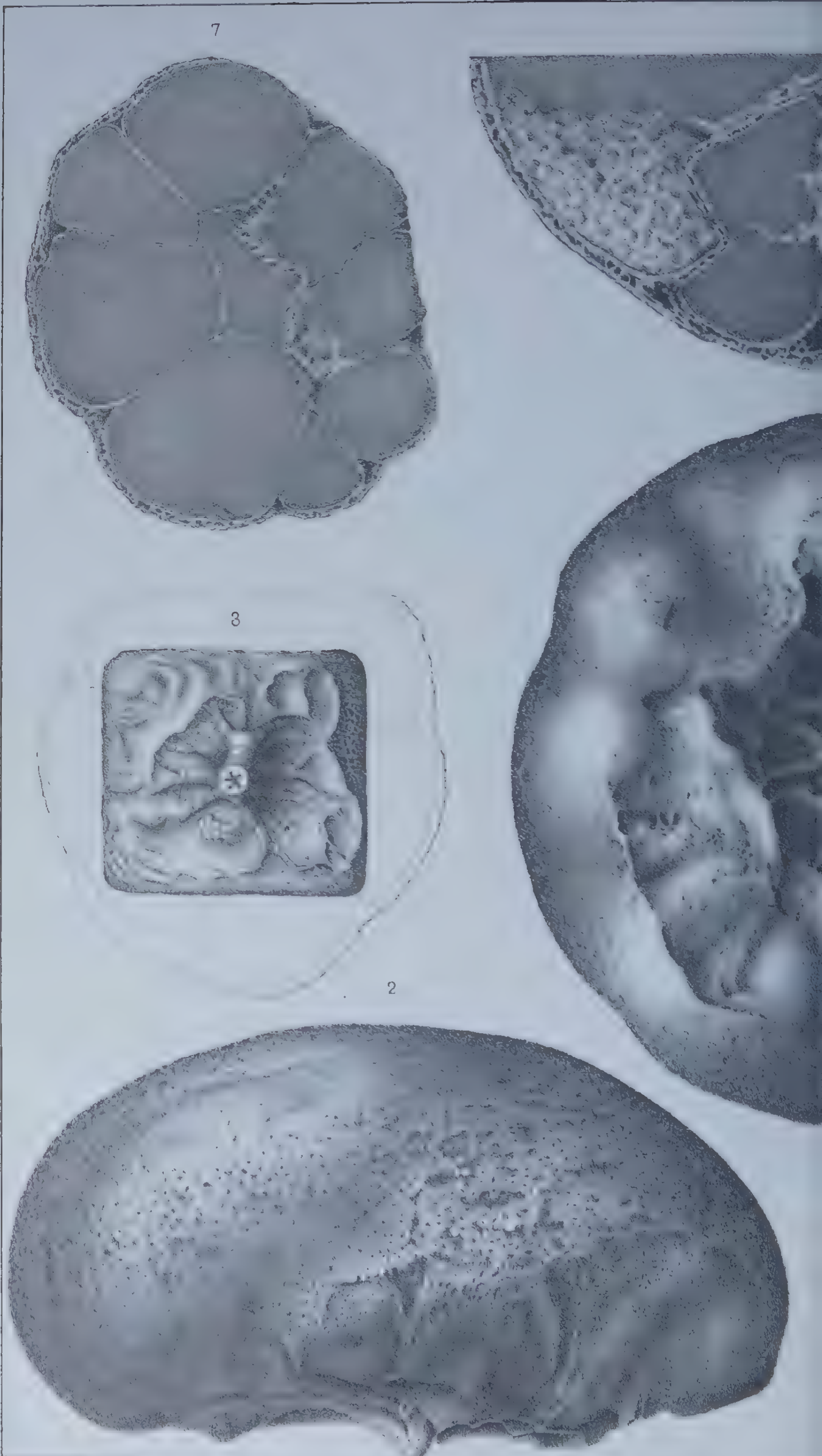

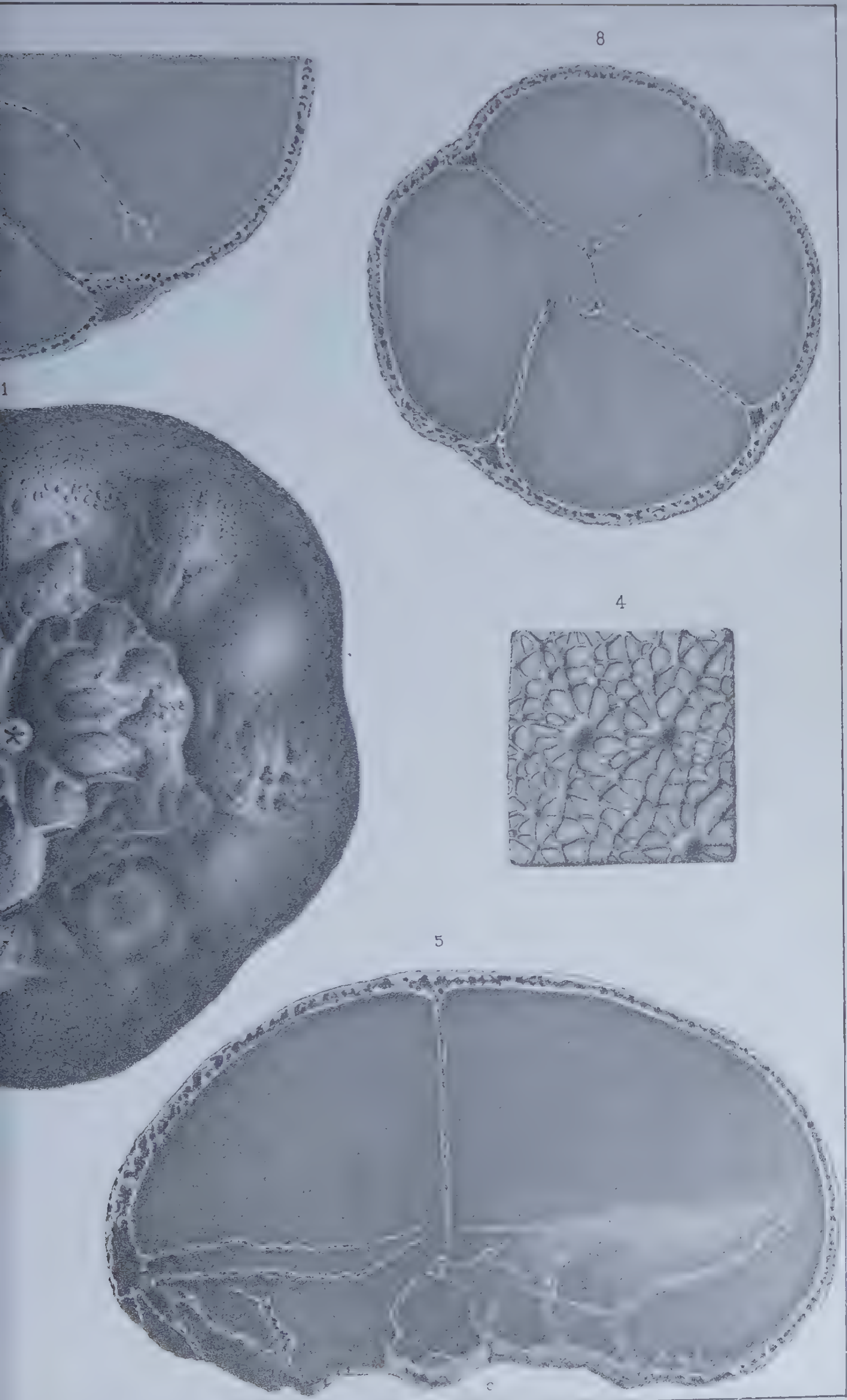
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PLATE XXXVI.

CAMAROCRINUS SAFFORDI.

Page 208.

Fig. 1. Basal view of a well-preserved specimen, showing the form and lobation of the body, the projecting imperfect margin around the basal area, and the structure of the base. In this specimen there are five large and distinct ambulacra, opening into the interior cavities, and the bases of two small accessory columns on opposite sides of the central one.

Fig. 2. Lateral view of a specimen, consisting of five equal lobes. The external layer of the walls has been removed from the upper portion, showing the plates of the internal walls.

Fig. 3. Summit view of an example, showing its laterally compressed form, owing to the great development of two of the internal chambers and the corresponding lobes, and a partial or complete atrophy of the others.

Fig. 4. Lateral view of a specimen of subspherical form, without any well-defined lobation of the dome. The plates have been removed in the process of weathering, giving to the surface much the appearance of a Favosite.

Fig. 5. The basal area of an example enlarged two diameters, showing in detail the structure of this portion of the body.

Fig. 6. An enlargement to four diameters of a portion of the surface of the exterior walls of a specimen, showing the irregular polygonal plates, and the impressed sinuous or cerenulate sutures.

CAMAROCRINUS CLARKII.

Page 209.

Fig. 7. Summit view of a specimen, showing the irregular form and unequal lobation of the body.

Fig. 8. *Id.* Basal view, showing the form, size, and position of the basal area, which is imperfectly preserved, but clearly indicates the numerous ambulacra, opening into the internal cavities.

The specimens illustrated on this plate are from the Lower Helderberg limestone, *Hardin county, Tenn.*

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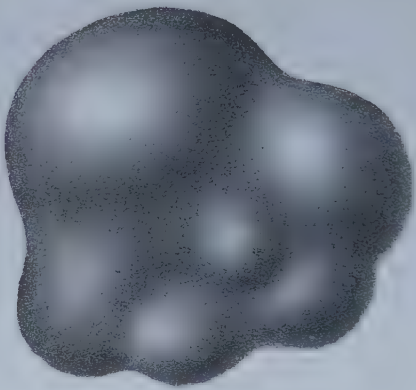

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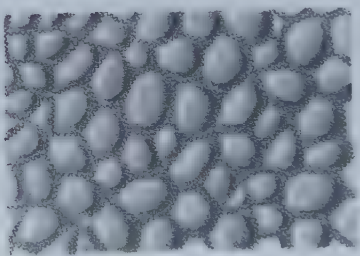

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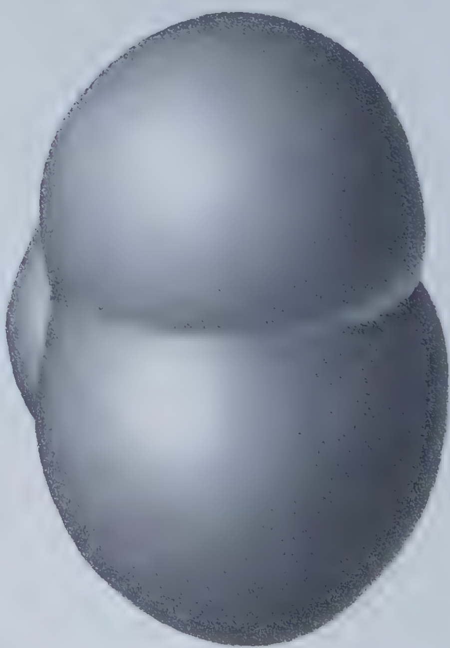

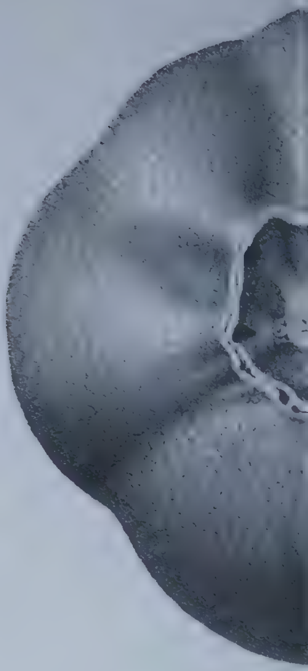

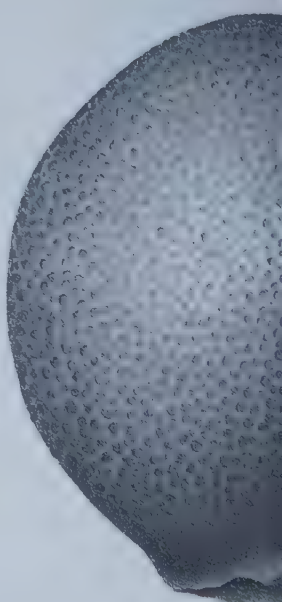

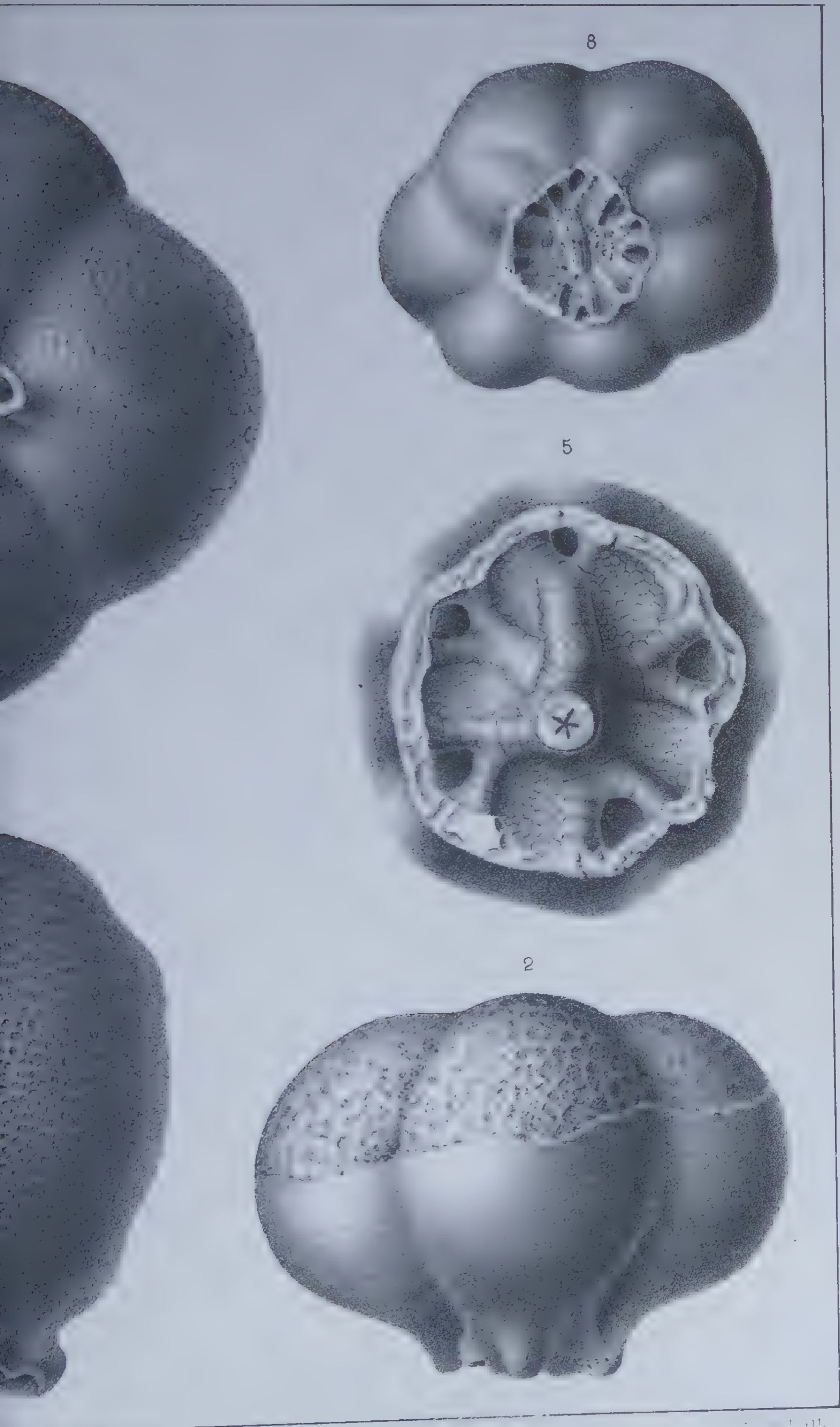
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PLATE XXXVII.

CAMAROCRINUS SAFFORDI.

Page 208.

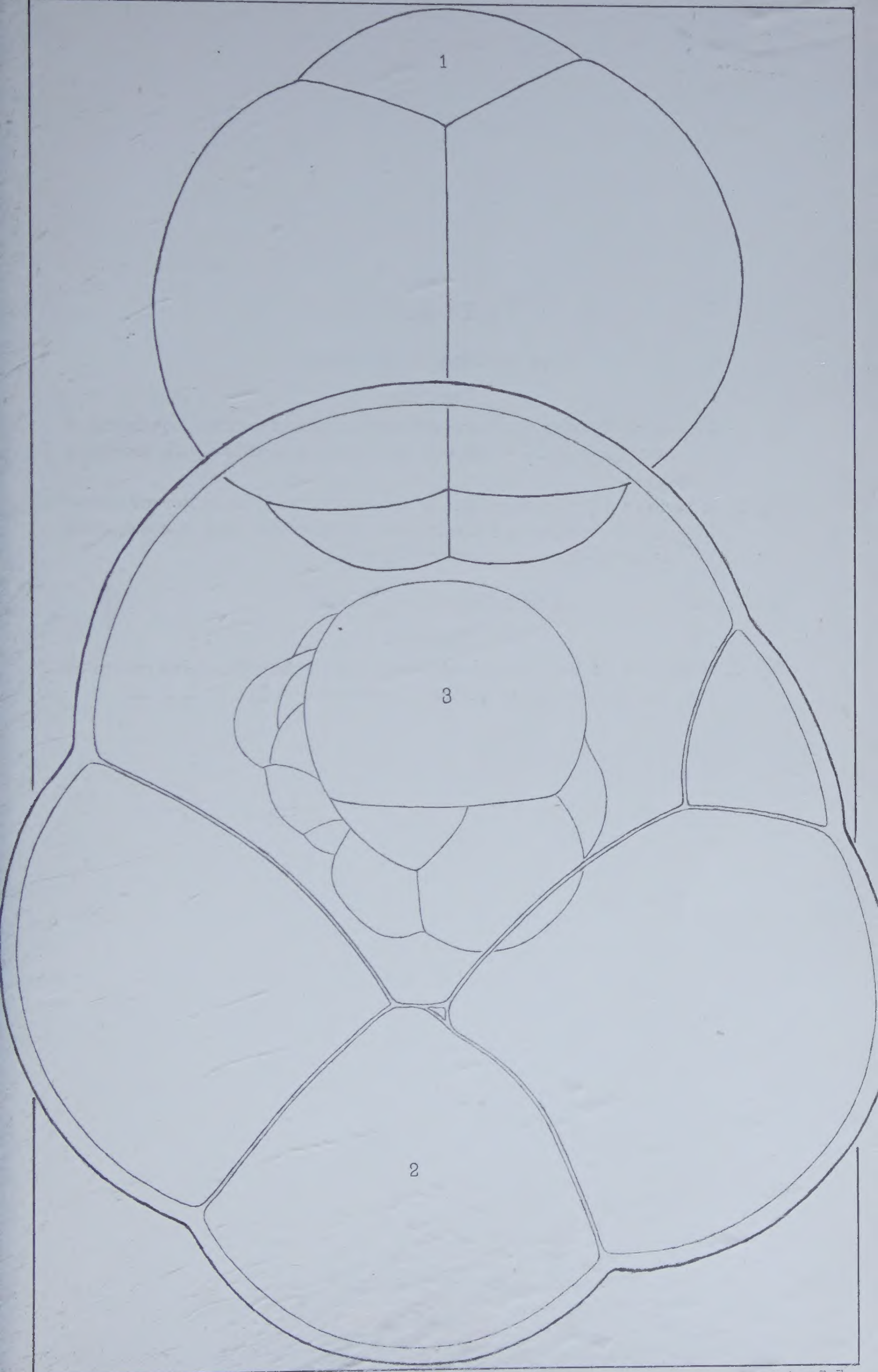
Fig. 1. An outline showing the form and lobation of a specimen, consisting of two large equal lobes and three smaller, nearly equal, accessory lobes.

Fig. 2. A horizontal section in outline, of the largest individual observed, showing the comparative thickness of the partitions and external walls, with five unequal internal chambers.

CAMEROCRINUS CLARKII.

Page 209.

Fig. 3. A diagram of the internal chambers, drawn from the lobes shown on the exterior of the specimen represented in figs. 7, 8, pl. 36.



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